Agriculture

PUBLISHED 6d MONTHLY

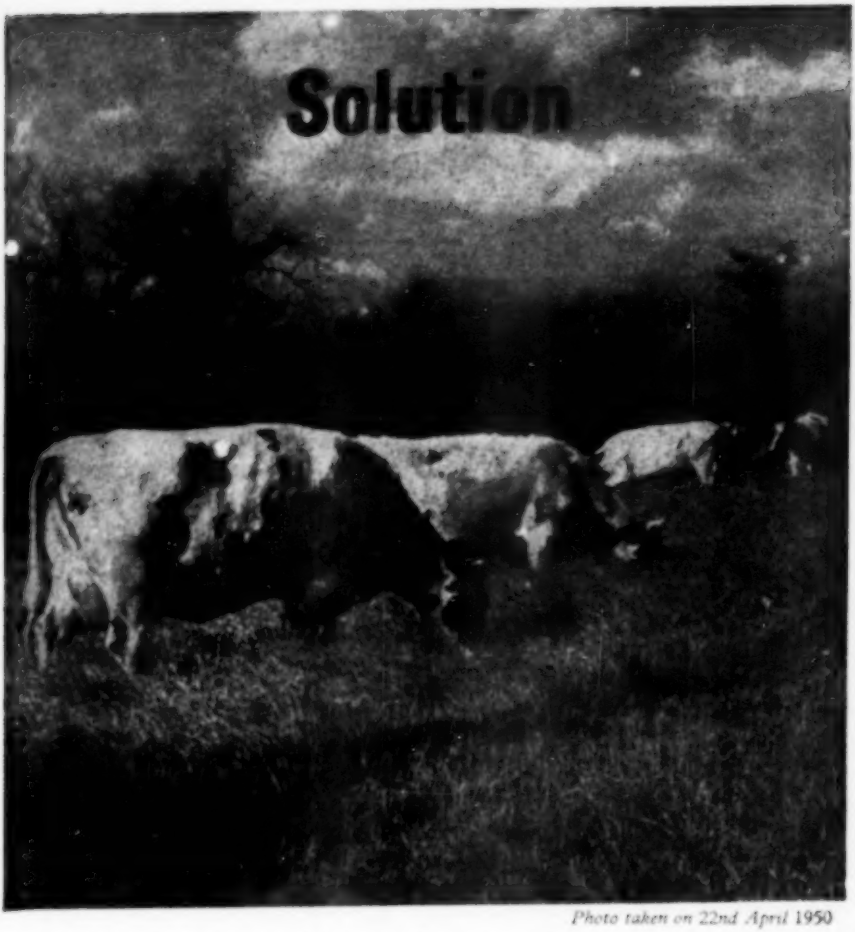


Photo taken on 22nd April 1950

. . . Grass—and grass only, even for cows giving over two gallons!

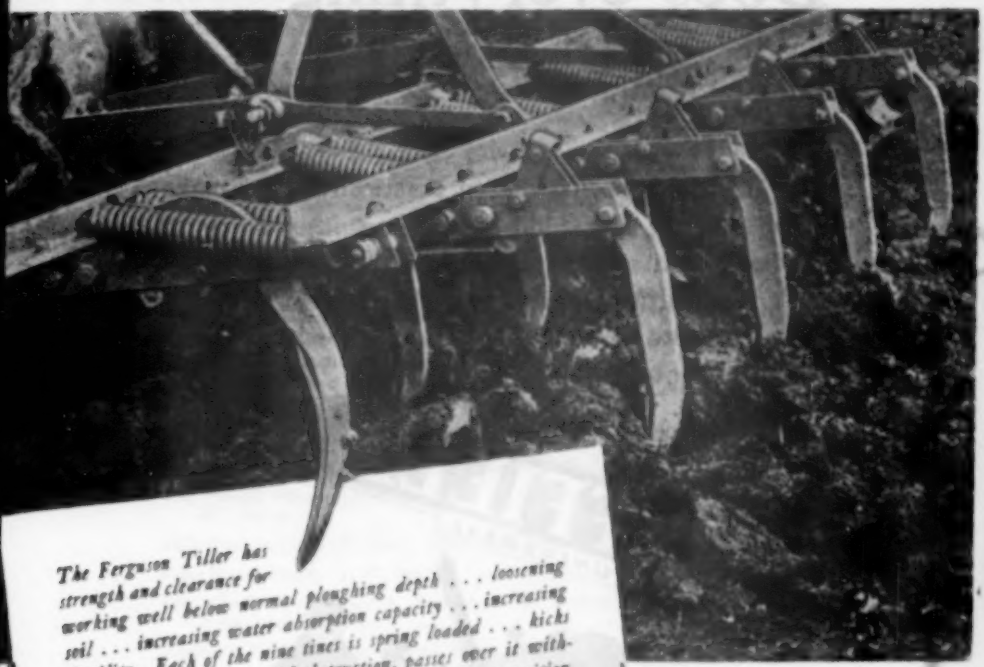
This ten-acre piece of Italian Ryegrass—which received two hundredweight of 'Nitro-Chalk' per acre early in March—carried fifty dairy cows from 3rd April to 24th April, 1950, and then gave a useful clearing-up bite to twenty vigorous stores for two more weeks. This is treating grass as it should be treated—as a crop to be grown when it is of the greatest advantage to the stock owner. And it is a help indeed towards the solution of a national problem—shortage of dollars and the consequent shortage of imported protein cattle foods.

To select the right field and the correct amount of fertilizer, ask for the assistance of the District Adviser, or the local representative of I.C.I.

ICI

IMPERIAL CHEMICAL INDUSTRIES LTD., LONDON, S.W.1

FASTER, CHEAPER CULTIVATION

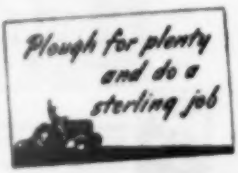


The Ferguson Tiller has strength and clearance for working well below normal ploughing depth . . . loosening soil . . . increasing water absorption capacity . . . increasing fertility. Each of the nine tines is spring loaded . . . kicks back when meeting a solid obstruction, passes over it without damage and springs back into normal working position. Equally efficient in large fields, small plots, or orchards.

Ferguson implements are attached to the tractor by one man in seconds by simple 3-point linkage and work as one unit with the tractor. Finger-tip and hydraulic control from the driver's seat raises and lowers them for easy transport . . . controls working depth . . . gives greater manoeuvrability in confined spaces. Light, sturdy, hard wearing, they cover more ground on less fuel . . . allow faster, cheaper, more accurate work under all conditions. Ask your Ferguson Dealer for a free demonstration on your farm and about the Ferguson Pay-as-you-Farm Plan.

ON ANY SIZE FARM—IT WILL PAY YOU, TOO—TO

FARM WITH FERGUSON



FERGUSON TRACTORS ARE MANUFACTURED FOR HARRY FERGUSON LTD., COVENTRY, BY THE STANDARD MOTOR COMPANY LIMITED

167A

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Editorial Offices : St. Andrew's Place, Regent's Park, N.W.1 (*Phone* : *WELbeck* 7711)

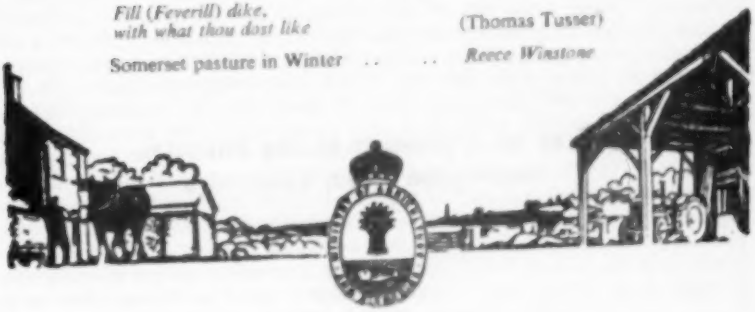
VOL. LVII No. 11 FEBRUARY 1951

Contents

Cover Photograph

Fill (Feverill) dike,
with what thou dost like (Thomas Tusser)

Somerset pasture in Winter *Reece Winstone*



Your Spring Cereals

Farmers' Leaflet No. 2

of the

National Institute of Agricultural Botany

lists the Recommended Varieties of spring wheat, oats and barley, annotated to show their respective merits, in relation to soil, ripening, yield of grain, and quality of straw.

Free on application to the Institute,
Huntingdon Road, Cambridge

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL LVII No. 11 FEBRUARY 1951

POTATOES FOR FATTENING PIGS

COMPARISON OF COOKED AND RAW POTATOES

R. BRAUDE, Ph.D. and K. G. MITCHELL, B.Sc.

National Institute for Research in Dairying, University of Reading

AN experiment was carried out at the National Institute for Research in Dairying with the idea of providing an exhibit of live pigs at the Royal Show at Oxford in July, 1950. The aim of the exhibit was twofold: first, to demonstrate that pigs fattened on cooked potatoes, along with a small amount of a well-balanced meal mixture, would grow at a rate very similar to that of pigs fed throughout their fattening period on meal only, thus making possible a considerable saving of meal; secondly, to compare the feeding value of raw potatoes with that of cooked potatoes.

The feeding to pigs of cooked potatoes, whether surplus ware, or those regarded as unfit for human consumption owing to their small size or slight damage, is an old-established practice and their value has been demonstrated in several experiments. For example, Woodman and Evans (1) showed that there was no significant difference in the rate of growth between one group of pigs fed an all-meal diet throughout their fattening period and another comparable group which received 3 lb. per head per day of meal, plus mineralized cooked potatoes; 4½ lb. of cooked potatoes were found to be approximately equivalent to 1 lb. meal.

There appears to be a wide divergence of opinion on the value of feeding raw potatoes to fattening pigs. Some reports state that owing to the presence of solanin, raw potatoes are poisonous to pigs, and condemn their use on this account, but the evidence in the literature on this point is very confusing. Davidson (2), in an experiment designed to compare raw and cooked potatoes with artichokes, stopped feeding the raw potatoes after 34 days, since the pigs receiving them had gained only 17.9 lb. and were very unthrifty. Thompson and Hargrave (3), on the other hand, successfully fed a ration of meal and raw, sliced potatoes according to appetite, and the average rate of gain of these pigs throughout the fattening period was 1.1 lb. per day, which compared with 1.4 lb. per day for a group of pigs given cooked potatoes. Hamed Nasr (4) also successfully fed a group of pigs 2½ lb. per head per day of meal, plus raw, sliced potatoes *ad lib.* Their average rate of gain throughout the fattening period was 0.87 lb. per day, compared with 0.98 lb. per day for a comparable group of pigs given cooked potatoes in amounts limited to the weight of raw potatoes which the other pigs would consume. He concluded that there was no evidence to suggest that raw potatoes in good condition (i.e., not green, immature or sprouted) were harmful to pigs in any way, and that although they were not so palatable or so well digested as cooked potatoes, under some conditions it might be an economic proposition to feed them to fattening pigs.

The Experiment For the experiment carried out at the Institute the Lehmann system of feeding was used, in which a small, fixed quantity of meal is fed throughout the fattening period, supplemented by the available bulky foods fed according to appetite. The experimental pigs each received 2½ lb. daily of the basal meal throughout, plus the potatoes either raw or cooked, fed according to appetite. Control pigs received an all-meal ration.

There were three treatments, and six pigs were placed at random on each treatment. A single experimental block consisted of 3 pigs, balanced as far as possible for initial weight, sex and litter origin. Eighteen home-bred Large White weaners (11–13 weeks old) from four litters were used to make up the six experimental blocks. Individual feeding was used and the pigs were weighed weekly throughout the experiment, an estimate of any food refused being made daily for each pig. The experiment began on February 20, 1950, and continued for 140 days for the control pigs and those fed cooked potatoes, and for 180 days for the group of pigs given raw potatoes.

The meal mixtures used in the experiment are given in Table 1. A sufficient quantity of each mixture was mixed before the experiment started to last for the whole experimental period.

Table 1

Percentage Composition of Meal Mixtures

	OA	OB	P
	per cent	*per cent*	*per cent*
Wheat offals	30	35	30
Barley meal	45	45	40
Flaked maize	15	15	15
White fishmeal	10	5	15
Percentage crude protein	16.3	13.7	19.0
Approximate price* per cwt. ..	28s. 4d.	27s. 3d.	29s. 2d.

*Current market prices in May, 1950.

All pigs received 1 oz. of cod liver oil once weekly, added directly to the troughs.

The three experimental treatments were as follows:

PEN 1. Controls. The six pigs in this pen received meal OA until they reached 150 lb. live weight. They were then given meal OB, which contained less protein supplement. The quantity of meal given was based on live weight and a scale whereby, at 49–51 lb. live weight, 2.5 lb. of meal was given, this quantity being increased by 0.1 lb. for each 3 lb. liveweight increase. Thus at 52–54 lb. live weight, 2.6 lb. of meal was given. At 166–168 lb. live weight, 6.4 lb. of meal was fed and, thereafter, the meal allowance increased by 0.1 lb. for each 6 lb. liveweight increase up to a maximum of 7 lb. The meal was fed twice daily as a wet mash, 3 lb. of water being allowed for each 1 lb. of meal.

PEN 2. The pigs in this pen received meal P as a wet mash on the same scale as the control pigs until, at 50 lb. live weight, each pig was receiving 2½ lb. daily. This quantity of meal was then kept constant and cooked potatoes were gradually introduced, the amount given being adjusted according to appetite, until towards the end of the experimental period, they received a maximum of 20 lb. per head per day. Six pints of water were added per day to allow for the 2½ lb. of meal in the ration. The basal meal P, which was fed throughout the fattening period, was higher in protein than the control mixtures to make up for the lack of protein in the potatoes. As the pigs got older they ate more potatoes, and consequently the protein content of the complete ration was gradually reduced.

PEN 3. Meal P was given to the six pigs in this pen in the same manner as for the pigs in Pen 2, but raw, whole potatoes were given according to appetite in place of the cooked potatoes.

The pigs in Pens 2 and 3 were fed twice daily until they had been receiving the potatoes for 15 weeks. Thereafter, they were fed three times daily at 7.30 a.m., 11.45 a.m. and 4 p.m. Equal quantities of the day's ration of meal and potatoes were given at each feed.

The potatoes for the pigs in Pen 2 were cooked in bins through which steam was passed for approximately 1 hour. Dustbins were easily adapted for this purpose by placing a false bottom, approximately 3 inches high, with small holes in it, inside the bin. A small pipe was fixed through the bin near the base. A rubber hose from the steam supply was connected to this pipe and the steam passed up through the false bottom to the potatoes on top. Sufficient potatoes were cooked at one time to last for two days, and they were allowed to drain in the bins and cool before feeding. The raw potatoes were fed whole, although any very large tubers were halved. In the later stages of the experiment appreciable sprouting had occurred in the potatoes, and the bulk of these were removed by hand either before cooking or feeding raw. Any green tubers and those showing signs of decay were also discarded.

The dry matter content in raw and in cooked potatoes was found to be very similar. In the two samples analysed the difference amounted to only 0.1 per cent of dry matter.

Potatoes Save Meal All the pigs were in good health throughout the experimental period. The pigs in Pen 2 obviously found the cooked potatoes palatable, and it was possible to give them steadily increasing quantities without causing any appreciable refusals of food. In marked contrast to this, however, the pigs in Pen 3 found the raw potatoes unpalatable, especially in the first weeks of the experiment, and the amounts that they would consume always remained well below those eaten by the pigs receiving cooked potatoes, as shown in Table 2.

Table 2

Average Daily Consumption of Potatoes during the Course of the Experiment

Week of experiment	Pen 2 Cooked potatoes	Pen 3 Raw potatoes
	lb.	*lb.*
5th	4.8	2.3
10th	8.8	4.5
15th	15.0	8.9
20th	20.0	12.7
25th		14.0

The results of the experiment are summarized in Table 3.

Comparison of the results for the pigs in Pens 1 and 2 shows that the mean liveweight gain of the control pigs during the 140 days experimental period was 10.8 lb. greater than that of the pigs receiving cooked potatoes. The pigs in Pen 2 would, therefore, have taken about a week longer to reach the same mean live weight as the pigs receiving an all-meal diet. As regards food utilization, the pigs in Pen 2 consumed on the average 1.8 lb. of meal less for each 1 lb. liveweight gain than the controls, but in addition, they consumed 8.43 lb. of cooked potatoes for each 1 lb. of gain.

The mean dry matter consumption per 1 lb. liveweight gain was 0.44 lb. less for the control pigs than for those receiving cooked potatoes. Although the control pigs were therefore rather more efficient in the use of dry matter, the results for the pigs fed cooked potatoes must be regarded as very satisfactory after taking into account the additional energy required for the mastication and digestion of the bulky potatoes. It is also of interest to make a comparison on a "meal" basis and, for this purpose, the cooked

potatoes consumed may be considered to take the place of the difference in meal consumption of the control pigs and those receiving cooked potatoes. On this basis 4.7 lb. of cooked potatoes are equivalent to 1 lb. of meal.

Table 3

Mean Liveweight Gain and Food Consumption Figures for the three Experimental Groups

	Pen 1 All-meal (Control)	Pen 2 2½ lb. day basal meal + cooked potatoes	Pen 3 2½ lb. day basal meal + raw potatoes
	lb.	*lb.*	*lb.*
Initial weight	55.3	56.2	55.8
Weight after 140 days	229.6	219.7	168.3
180 days	—	—	217.1
Liveweight gain in 140 days ..	174.3	163.5	112.5
180 days ..	—	—	161.3
Daily gain 140 days	1.25	1.17	0.80
180 days	—	—	0.90
Meal consumed per lb. liveweight gain	3.90	2.10	2.77†
Potatoes consumed per lb. liveweight gain	—	8.43	7.90†
Total dry matter* consumed per lb. liveweight gain ..	3.39	3.83	4.29†
Pounds of potatoes replacing 1 lb. of meal	—	4.7	7.0†

*Calculated on basis of figures given by Woodman in *Rations for Livestock*, Ministry of Agriculture Bulletin No. 48 (1948).
†Based on 180 day fattening period.

The mean total consumption of meal per control pig was 680.4 lb., as against 342.7 lb. for a pig fed cooked potatoes, a saving of 337.7 lb. Allowing for the extra few days needed by the latter to reach the same live weight as the controls, this represents a net saving of over 45 per cent of meal.

Comparison of the results for the pigs in Pen 3 (which received raw potatoes) with those pigs in Pen 2 (which were fed cooked potatoes) shows that the rate of growth of the former was appreciably lower; in fact they required 40 days longer to reach approximately the same weight as the pigs in Pen 2. After 140 days, the mean liveweight gain of the pigs in Pen 3 was 51.0 lb. less than that of the pigs in Pen 2.

The efficiency with which the pigs in Pen 3 utilized their food was correspondingly lowered, consuming as they did 0.46 lb. more dry matter per 1 lb. liveweight gain than did the pigs receiving cooked potatoes. In addition, it is seen in Table 3 that 7.0 lb. of raw potatoes were required to replace 1 lb. of meal, as compared with 4.7 lb. of cooked potatoes.

The fact that the raw potatoes were so unpalatable resulted in insufficient being consumed to cover the nutritive requirements of the pigs for normal growth. It is obvious, therefore, that this unpalatability and the resulting low consumption of the raw potatoes, was one of the factors responsible for the slower rate of growth of the pigs in Pen 3. In this connection, two factors should be borne in mind which might have had the effect of exaggerating this unpalatability. First, the raw potatoes were fed whole and it was apparent that the pigs, especially in the early stages, had difficulty in biting them. Secondly, the potatoes were introduced when the pigs were only about 12–14 weeks old.

In the later stages of the experiment, it was observed that the pigs in Pen 3 appeared to utilize the raw potatoes more efficiently. Their rate of growth

improved without a corresponding increase in the amount of potatoes consumed by them. Hamed Nasr (4) fed some pigs raw potato starch and obtained some evidence of the establishment of a specific micro-organism in their caecum which was able to effect the breakdown of the starch granules. One could speculate that, at some stage in our experimental period, a similar change in the micro-flora of the digestive tract took place, resulting in an improved efficiency with which the pigs utilized the raw potatoes.

In spite of the slower overall growth rate, the feeding of the raw potatoes made possible a very substantial saving in meal. The mean total consumption of meal by a pig receiving raw potatoes was 446.8 lb., compared with 680.4 lb. consumed by a control pig—a saving of 233.6 lb. of meal per pig. Again allowing for the extra time taken by the former to reach the same live weight as the controls, this represents a net saving of about 30 per cent of meal.

Carcass Quality After slaughter, the carcasses of all the experimental pigs were examined by expert graders at the bacon factory, and determination of the iodine number of samples of loin fat from each pig was made by Mr. D. P. Gatherum of the Low Temperature Research Station, Cambridge. The average points allocated were very similar and put all the groups in the good quality grade, although the pigs receiving raw potatoes were rather leaner than those of the other two groups. This was most probably the result of their insufficient intake of food throughout their fattening period. This aspect should be borne in mind in relation to the recently introduced quality premium which is not paid unless the back fat measurement at the thinnest point is greater than $\frac{1}{2}$ inch.

The mean iodine numbers for outer layer of the shoulder and the loin fats were as follows:

	Pen 1 Control	Pen 2 Cooked Potatoes	Pen 3 Raw Potatoes
Shoulder fat	77.8	71.8	82.4
Loin fat	77.2	69.7	81.0

In comparing these values, it should be borne in mind that all the pigs received cod liver oil throughout the fattening period, and that maize was included in the meal mixtures. As a result, all the fats were rather soft, and before the war, when strict grading was in operation, they would have been penalized on this account. However, these iodine numbers are interesting because they show a significant difference between the fats from pigs receiving the cooked potatoes as compared with those receiving raw potatoes. Further, the fats from the cooked potatoes group were significantly harder, while those from the raw potatoes group were significantly softer, than the fats from the control group.

Economic Aspects The financial returns obtained are of great practical importance and, in order to make a fair comparison of the returns from the three experimental groups, the average cost of the food consumed by a pig in each of the three Pens in making a liveweight gain of 180 lb. (50 lb. to 230 lb. live weight, or approximately 9 score dead weight) was calculated from the food utilization figures given in Table 3.

The amount of steam required to cook a bin full of potatoes (112 lb.) was found to be 40 lb. To provide this amount of steam from equipment specially provided for this purpose, and allowing for its depreciation, was found to cost approximately 1s. 10d. On the other hand, if, as in this experiment, the steam is obtained as a by-product from equipment used

for other purposes, the cost was found to be approximately 7d.

Valuing raw potatoes at £5 a ton and the meal mixtures used at the prices given in Table 1, the approximate costs shown in Table 4 are obtained.

Table 4

Total Cost of Food Consumed per Pig in making a Liveweight Gain of 180 lb.

		£	s.	d.
Pen 1.	Meal only	8	14	4
Pen 2.	2½ lb. meal + cooked potatoes			
	(a) cost of cooking potatoes at 7d. per cwt.	8	14	2
	(b) cost of cooking potatoes at 1s. 10d. per cwt.	9	11	2
Pen 3.	2½ lb. meal + raw potatoes	9	13	7

In order to arrive at the net profit obtained per pig under the three systems of feeding, the cost of the weaners, overheads and labour costs must be added to the figures given in Table 4. The labour costs for the pigs fed potatoes will be slightly higher than for the pigs fed on meal only. In addition, for the pigs fed raw potatoes, the running costs will be higher, owing to their slower rate of growth, a point to be specially borne in mind under conditions of intensive pig-keeping, where a quick turnover is aimed at. Nevertheless, at present-day prices, our results indicate that there should be a margin of profit for the pigs on all three systems of feeding.

Conclusions The results of this experiment confirmed that the rate of growth of pigs fed cooked potatoes along with 2½ lb. per day per pig of a well-balanced meal, was only slightly below that of pigs fed on meal only. The feeding of cooked potatoes resulted in a saving of approximately 45 per cent of meal and it was found that 4.7 lb. of cooked potatoes were required to replace 1 lb. of meal. The pigs fed raw potatoes took 40 days longer to reach slaughter weight than the other two groups, and also the efficiency with which they utilized their food was lower, but nevertheless the saving of meal was quite appreciable.

Taking the economic aspects into consideration, it appears that under intensive systems of pig-keeping, potatoes should be fed cooked while under extensive systems, where time, labour and running costs are not of primary importance, raw potatoes can be fed satisfactorily.

References

1. Woodman, H. E. and Evans, R. E. *J. agric. Sci.* 1943, **33**, 155–68.
2. Davidson, H. R. *Essex Fmrs'. J.*, 1927, **5**, 470–71.
3. Thompson, J. K. and Hargrave, J. *J. Min. Agric.* 1936, **42**, 1123–27.
4. Hamed Nasr. *Ph.D.Thesis, Rowett Inst.* 1949.

THE POTASH MANURING OF LUCERNE

J. O. Jones, M.Sc. and W. Dermott, M.Sc.

National Agricultural Advisory Service, Wye, Kent

THE shortage of high protein feedingstuffs has focused attention on the value of lucerne, and recent years have seen a considerable increase in the acreage of lucerne leys grown in south-eastern England. As is well known, lucerne will tolerate only a slight degree of acidity, and it requires regular phosphatic manuring to ensure maximum yields. Even on farms where the management and manuring of lucerne leys were at a high standard, however, a number of complaints were received during the course of advisory work that the life of the ley was short, often only two or three years. Examination of such leys or grass-lucerne leys often revealed lucerne plants showing the yellowing and necrotic spotting characteristic of potash deficiency, such plants gradually dying out and being replaced by the companion grass or, more often, by weed grasses. The majority of such cases was reported on the low-potash soils derived from the chalk formation, but cases were also seen on other formations, including the lighter soils of the Hastings Beds. When the histories of such fields were discussed with the farmers concerned it was usually revealed that either no potash had been applied or that only a light dressing of a potash-containing fertilizer had been given, often at the time of sowing the ley. In point of fact, this was hardly surprising, as little experimental work had been carried out on the point since the classical manurial trials at Woburn at the end of the nineteenth century, and the majority of the standard text-books do not place much emphasis on the potash requirements of the crop.

Details of the Experiment It appeared to the writers, therefore, that it would be worth trying the effect of varying dressings of potash on the productivity and longevity of lucerne leys, and thanks to the courtesy of Mr. William Alexander of Eynsford, Kent, it was possible to lay down an experiment in the autumn of 1947. The field chosen was on the side of a valley cut in the Upper Chalk, the soil varying in depth from a few inches over sedentary chalk at the top of the field to a considerable depth of flinty colluvium and alluvium at the bottom. The field was then in the second year of a lucerne ley, the upper half of it being sown with a lucerne-cocksfoot mixture, and the lower with a lucerne-timothy mixture. Analysis of soil samples revealed ample supplies of lime and available phosphate, but a deficiency of available potash, and slight symptoms of potash deficiency were beginning to appear in the crop. The symptoms were rather more severe in the lower part of the field, and this was correlated with a lower potash status in the soil, as compared with the higher area. Low potash levels are, of course, common in down-wash soils, due presumably to leaching during their formation.

The experiment itself consisted of 1 acre strips running up and down the field (that is, across the two seeds mixtures) receiving the following dressings of muriate of potash: 0 (control), 1 cwt., 2 cwt., 3 cwt. and 4 cwt. per acre. The first applications were broadcast in November, 1947, and further dressings of muriate of potash have been given at the same rates each subsequent autumn.

During the summer of 1948 differences began to appear between the treatments, the lucerne being less vigorous and much yellower on the control

plot. This effect became still more apparent in 1949, when the untreated strip stood out in marked contrast to the rest of the plots. It was also possible to differentiate between the various treatments, the plots receiving 1 and 2 cwt. per acre of potash being less vigorous than the plots receiving 3 and 4 cwt. Trial cuts in both years indicated that there was a substantially lower yield of green material on the control plot. By 1950 almost all the lucerne had died out of the untreated area, the plots receiving 1 and 2 cwt. of potash per acre were moderately good, while the plots receiving 3 and 4 cwt. contained a high proportion of lucerne (see art inset).

Effect on Yield and Vigour The yields of green material from the plots in the second cut of 1950 are given in Table 1.

Table 1

Yield of Plots in Second Cut 1950—Cocksfoot and Lucerne Only

	tons per acre
Control	1.70
1 cwt. Potash	2.39
2 " "	2.52
3 " "	3.53
4 " "	3.66

It will be seen that there is a difference in yield of nearly 2 tons per acre between the untreated plot and the plot which had received three dressings of 4 cwt. muriate of potash per acre, and in addition, of course, while the former was almost entirely grass the latter was largely lucerne.

Table 2

Vegetative Characteristics of Lucerne on Lucerne/Cocksfoot Plot

Plot	Plants per Square Yard	Number of Shoots per Plant	Average Height of Shoots
			in.
Control	27	7	9
1 cwt. potash	32	8	11
2 cwt. potash	47	13	14
3 cwt. potash	53	15	15
4 cwt. potash	48	19	15

Table 2 records some counts and measurements made on the plots during the summer of 1950. It will be seen that the effects of potash shortage have been not only to reduce drastically the number of plants but also to decrease the number of shoots per plant and the height of the individual shoots.

Herbage and Soil Analyses Chemical analyses were made of the herbage from time to time, and since one or two points of interest emerge, the figures for the lucerne from the second cut of 1949 are quoted in full in Table 3

Table 3

Percentage Analysis of Dry Matter (Lucerne only)

Plot	Protein	Ash	P_2O_5	K_2O	CaO	MgO
Control Cocksfoot/Lucerne	18.37	6.93	0.61	0.51	4.38	0.39
Control Timothy/Lucerne	20.78	6.94	0.69	0.55	3.94	0.50
1 cwt. Potash Cocksfoot/Lucerne	15.75	7.68	0.46	0.94	3.50	0.31
1 cwt. Potash Timothy/Lucerne	18.59	9.88	0.58	0.98	4.74	0.42
2 cwt. Potash Cocksfoot/Lucerne	15.20	7.99	0.43	1.53	4.06	0.39
2 cwt. Potash Timothy/Lucerne	18.81	8.19	0.51	1.61	3.50	0.62
3 cwt. Potash Cocksfoot/Lucerne	17.06	8.64	0.45	1.69	3.82	0.34
3 cwt. Potash Timothy/Lucerne	20.34	8.52	0.61	1.77	3.70	0.35
4 cwt. Potash Cocksfoot/Lucerne	17.28	9.14	0.43	1.73	3.03	0.36
4 cwt. Potash Timothy/Lucerne	16.84	9.75	0.61	1.96	3.03	0.42

As was expected, the potash (K_2O) content of the plants increased with increased dressings of muriate of potash, the figures ranging between 0.51 per cent of the dry matter on the control cocksfoot-and-lucerne plot, to 1.96 per cent on the 4 cwt. timothy-and-lucerne plot. The lucerne samples for analysis were taken from the boundaries between the two seeds mixtures, so as to minimize effects due to soil variation. It will be noted, however, that the lucerne grown with cocksfoot appears to have shown a generally lower mineral status than that grown with timothy, and it would seem that the former grass competed more keenly with the lucerne for the available plant nutrients than the latter.

Soil samples were also taken annually from the plots for chemical analysis, and the most striking point to emerge from a study of these figures is the relatively small increase in the available potash content of the soil even on the plot which had received a total of 12 cwt. of muriate of potash per acre. As however, a crop of lucerne may remove the equivalent of up to 3 cwt. muriate of potash per acre annually perhaps this result is hardly surprising.

Conclusions The experiment described above shows that the lucerne crop has a high demand for potash and that under conditions of potash deficiency the yield and length of life of the crop is seriously reduced. On potash-deficient soils it is recommended that 3 cwt. muriate of potash per acre should be applied before sowing the seeds mixture and that this should be followed by annual dressings of 3–4 cwt. muriate per acre.

MILK PRODUCTION IN CHESHIRE

HUGH MCFADZEAN, B.Sc., N.D.A.
National Agricultural Advisory Service, W. Midland Province

CHESHIRE and milk production have been practically inseparable for generations, and it is probably correct to say that no other county has such a specialized agricultural industry. It is heavily stocked, the county carrying over 140,000 cows on its 476,000 acres of agricultural land. If due allowance is made for young stock and sheep, and appropriate deductions are made for the area under wheat and potatoes, the average stocking amounts to one cow equivalent per 2.1 acres. Traditionally the county is a cheese-making area, but the number of makers has declined continuously for the past century; there were only about 200 at the outbreak of war, and during the war they shrank to a mere handful. Because of the cheese-making tradition, with its spring-calving herds, winter output of milk still tends to be lower than summer output, though there has been a steady movement during the past ten years towards levelling up production. At the outbreak of war 44 per cent of the annual output was produced in winter; by 1948–49 this proportion had risen to 47 per cent.

More Milk per Cow During the first three years of the war there was a marked drop in total milk production, due partly to the introduction of the rationing of feedingstuffs, partly to a decrease in the cow population, and partly to an increase in the tillage acreage and the diversion of the produce of this land to other uses. By 1943 the downward trend had ceased and an increase in the number of cows was followed by a proportionate increase in milk production. Since then, for five successive years, the total gallonage has increased steadily while the number of cows has fallen. In other words, the average output per cow has risen year by year and now amounts to 215 gallons per acre over the whole county (omitting the area under wheat and potatoes), and the average quantity of milk sold per cow has risen from just over 500 gallons in 1939 to almost 610 in 1949.

To what can we attribute these results? There appears to be a number of factors to which credit must go, and some of these are listed below. It is not possible to say which has had the greatest influence; indeed, several are complementary and cannot be of much value without the others; thus, the order in which they appear is not intended to indicate their relative merits.

Improved Management. There can be no doubt that the standard of cowmanship has improved over the years, and that the handling of dairy cattle, the utilization of available foods, milking methods and general cowshed routine are better than they have ever been.

Changes in Cattle Breed and Type. It is not possible to obtain figures to show how the traditional Dairy Shorthorn has largely been replaced in the county by the British Friesian, and, to a much lesser extent, by the Ayrshire, both breeds which appear to fit into the Cheshire landscape very satisfactorily. Bull licensing statistics show the general trend, and a survey carried out in 1944 showed that just over 50 per cent of the bulls in use in the county were of Friesian type.

Swing to Winter Milk Production. It is well known that cows calving in the autumn and early winter generally give a better milk yield than spring-calving cows. Returns of calves born during different quarters of the year

are available only for the last few years, but it is of interest to note that in 1949–50 calves born during September–February inclusive came to 66 per cent of the total cow population.

Disease Control. The virtual elimination of contagious abortion by the use of S.19 vaccine at some stage or stages in the life of the dairy animal must have been of enormous value in cutting out the losses due to this disease. The introduction of the sulpha drugs and penicillin in the treatment of various forms of mastitis, together with the more frequent recognition of, and prompt attention to, any udder troubles, have undoubtedly lengthened the useful life of many cows.

Although losses from contagious abortion and the forms of mastitis associated with the streptococcal organisms have been greatly reduced, summer mastitis or "August bag" remains a serious problem and a definite deterrent to increased production, particularly in the months of August and September, which have now become the season of scarcity. Occurring as it does in dry cows, it has the effect of making many dairy farmers reluctant to have a large number of dry cows during the late summer and early autumn, and this will remain a problem until a remedy is found.

The elimination of tuberculosis goes on steadily. Some temporary dislocation of milk production in individual herds is, of course, almost bound to occur, but the subsequent benefits will more than offset the loss; moreover, as the proportion of farmers changing at any one time is but a tiny fraction of the 6,000 milk producers, the overall effect is negligible.

Constructive Breeding Policy. The use of bulls of known high production ancestry, and the retention of the majority of their daughters for herd replacement, is now having its effect in many herds, and while the results of artificial insemination are only just beginning to show themselves, the benefits should soon be apparent in many of the smaller herds where the standard of the bulls used previously was rather low.

It may be of interest to note that although the county's cow population has fluctuated, the numbers of young female cattle have at no time shown a marked fall, and since 1945 have been fairly steady, showing an increase over the 1939 figure of the order of 10 per cent. This seems to indicate that a greater measure of self-sufficiency for herd replacements has been the aim.

Increased Production of Home-Grown Foods. Before the war these heavily stocked Cheshire farms, with their large areas of permanent grass, were dependent to a great extent on the mills of Merseyside for much of the food from which the milk was produced. It seems fair to conclude that the fall in output during the early war years was due to curtailment of these supplies, the ploughing up of some grass and the diversion of its produce to other channels; it may also have been due to the unfamiliarity of farmers with the new system of husbandry forced upon them. Increased efficiency in arable husbandry, better equipment for crop handling, more effective weapons in the war against weeds and insect pests, and a slight but steady increase in the supply of rationed feedingstuffs, all helped in the years from 1944 onwards, but an even greater part was played by improved techniques in grassland establishment and management, and the conservation and utilization of its produce.

Some Farms below Standard Although there has been an increase in production throughout the county as a whole, the improvement has by no means been uniform. There are farms on which production has not increased at all since the beginning of the war, and farms

where production per cow is well under 400 gallons and less than 150 gallons per acre, while neighbouring farms with comparable natural attributes often show something like double the output.

The Agricultural Executive Committee and officers of the National Agricultural Advisory Service have devoted much time to the study of the problems presented by these farms. As a rough guide it has been found useful to calculate the output per acre of fodder land. Though this figure is subject to many qualifications and does not indicate the cause of low output, it is a measure of the standard of management, and sometimes a clue to probable weaknesses. Discovery of the cause may or may not be a simple matter.

Low production can result from a variety of causes, some of which are amenable to treatment and some presenting great difficulties. In the great majority of cases, the farmer himself is largely responsible for the lack of success of his enterprise, though there are times when misfortune and consequent low output are due to circumstances beyond his control.

Apart from misfortune and disease in the herd, which may have a temporary effect, and really bad farms, of which Cheshire has only a few, most instances of low production are associated with a low standard of farming generally. This may be due to failure to apply modern knowledge, a lack of ambition or a resignation to misfortune, or it can be due to old age or ill health. The last two are difficult to deal with, but the other cases can usually be made to show some response to advice and assistance.

On such farms the class of cattle kept is usually of low grade, though in many cases, if adequately fed they could be made to show improvement. Unless the standard of cow management can be raised, there is little point in raising the standard of the animals themselves; but since stock improvement is of necessity a slow process, especially where resources are limited, the sooner some definite breeding policy is inaugurated by such farmers the better.

In past years low-grade cattle, especially on the smaller farms, were often the result of using inferior bulls and rearing indiscriminately from cows because they happened to have heifer calves at a time considered to be convenient for rearing. Artificial insemination can be of great help, but its success depends to a great extent on the observation and prompt action of the man in charge of the herd and on the condition of the cows, and on the low-grade farm weakness in these respects may result in delay in getting cows in calf. As a result the farmer is easily discouraged and reverts to the use of a low-priced and usually inferior bull in an attempt to get his cows back into production.

Inadequate or unsuitable labour can be responsible for low output, but where this condition arises it is usually due either to lack of housing or other amenities, or to the farmer being a bad employer. The remedies here are obvious but often difficult to apply.

Milking methods, times of milking, general shippon routine, all have their effect and show up not only in the quantity but in the quality of the milk produced, and in the health and well-being of the cows themselves; in this field improvement can frequently be effected fairly rapidly.

Poor management is usually associated with inadequate food supplies, and the initial steps must be either to secure more or to reduce numbers to fit the supply. In most cases a combination of these is the solution. The efficient utilization of available feedingstuffs, too, can make a big difference. One hundredweight of concentrates fed to fourteen cows at 8 lb. per cow may be robbing some and over-feeding others, and while much progress has been made in the practice of feeding to maintain and encourage production,

there is still room for applying the knowledge available. In the end, however, the provision of adequate supplies of food is the first essential. The modern dairy cow is a converter of fodder into milk, and the ultimate output inevitably depends on an adequate supply, efficiently used.

A higher standard of general farming, heavier crops suitable for feeding for milk production, better methods of harvesting and conserving crops, up-to-date systems of grassland and grazing management, feeding according to the requirements of the individual cow, vaccination against diseases such as contagious abortion, prompt treatment of mastitis when it arises, with regular precautions against its occurrence—all these play a part and must be woven together into a constructive herd policy if a real increase in milk production is to be obtained.

CLUN FOREST FARM

J. W. Reid, F.A.C.(Glas.), N.D.A.

County Agricultural Officer, Shropshire

THE little town of Clun, situated on the river of that name, nestles among the south Shropshire hills. It stands at the junction of a number of roads which lead north to Bishop's Castle and Shrewsbury, south to Knighton and to places in the hills such as the New Invention, west to Newcastle, the Anchor Inn just on the border of Wales, and thence to Kerry and Newtown, and east to Craven Arms and Ludlow. The town itself lies 600 feet above sea level, but all round it the uplands rise to heights of 1,000 to 1,300 feet. Clun Hill itself is 1,292 feet.

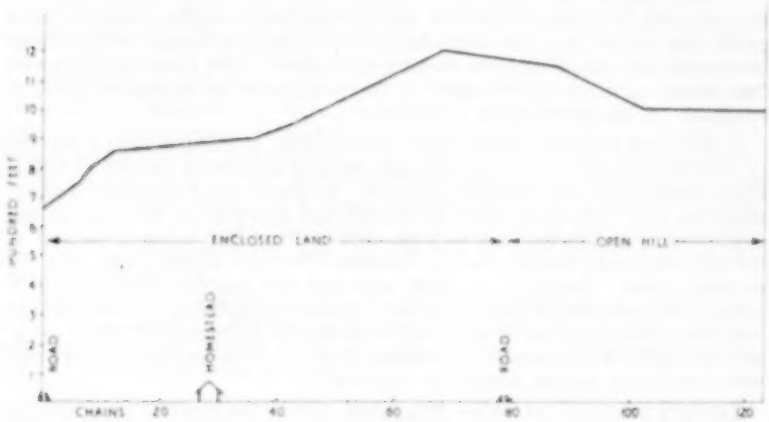
In the good old days Clun Castle, now in ruins, must have been a bastion of the border country, as was also the notable earthwork known as Offa's Dyke which runs over the hills close by. In more recent years the district, which at one time must have flourished, had suffered in the agricultural depression, and bracken and to a less extent thorn had taken command of the highlands and indeed pushed invaders down the lower slopes into the enclosed lands. Some of the hills were and are heather covered, and in places there are whinberries and gorse. Contributing factors to this change were the reduction of cattle in favour of sheep, the dying out of the hill pony, and the drift of the human population from an area lacking in amenities which so many people regard as essential.

Today a new spirit pervades these lands, due to the renewed prosperity of agriculture, the coming of the crawler tractor and the mechanical spreader, but above all to the enterprise and initiative of many of the farmers. The typical farm of the district has a small area of level narrow valley land, a larger area of enclosed land, rising in varying degrees of steepness, and on the top an open hill. The riverside land is naturally fertile, the enclosed land responds well to management and fertilizer, and on the majority of the hills there is an easily worked rather heavy red loam varying in depth but normally around 2 feet. Where heather prevails the soil is of much poorer type and may be peaty. A peculiarity of the hills is that the tops are usually flat and often need drainage before improvement can be effected.

Weston Farm On Lady Day, 1939, Mr. R. E. Morris came in from Radnorshire and took over the tenancy of Weston Farm, the homestead of which lies about 1½ miles from the town of Clun. This farm then comprised 462 acres, of which 62 acres were low ground, 64 acres classified as rough grazing, 169 acres enclosed land, and 167 acres open hill partly covered with bracken, partly with heather and with patches of gorse and whinberries. Only 20 acres were in arable cultivation and much of the grassland was capable of improvement. That first year the stock on the farm was 12 Hereford breeding cows and 160 Welsh ewes.

In 1948 Weston Farm was offered for sale in two lots, and Mr. Morris purchased all except the 62 acres of riverside land which were undoubtedly the most valuable part of the farm. Today the 400 acres left carry 28 breeding cows and a flock of approximately 300 ewes, and winter some 56 young cattle. Thus production has been markedly increased in the past eleven years, and is likely to go higher still in the next three years. How has this transformation been effected?

From the first year he entered the farm, Mr. Morris has made full use of the plough and today only 36 acres of permanent pasture remain untouched; even the whole of the open hill has been ploughed. Woodland and rough dingles account for some 20 acres, and on the effective acreage of 380 in 1950 there were on the enclosed land 74 acres of tillage, 44 acres of temporary grass, 59 acres of long leys and 36 acres of permanent grass, and on the open hill 117 acres of grassland and 50 acres of pioneer crops, mainly rape.



SECTION TAKEN THROUGH WESTON FARM

The plough has been used with discretion. In 1939, 17 acres were ploughed and the maximum dealt with on the enclosed land in any one year was 26 acres. The first object of ploughing was to increase the land under rotational cropping and later, in 1945, a start was made with reseeding. The policy has been to do a moderate amount each year and to do it well.

The rotation and fertilizer programme adopted on the enclosed land is set out below:

Oats	No fertilizer
Oats	10 cwt. per acre basic slag before sowing
Roots (Turnips and Swedes)	Lime as required 10 cwt. per acre basic slag and 3 cwt. compound fertilizer
Oats	No fertilizer
Seeds (1)	10 cwt. per acre basic slag immediately the nurse crop is removed
Seeds (2)	No fertilizer

Reliance is placed on the Star and Eagle oats, which yield on the average 20 cwt. per acre and, exceptionally, up to 30 cwt.; Best of All and Tipperary swedes are grown; the seeds used are two-year commercial type leys.

Enclosed land reseeded out of old permanent pasture has sometimes had two cereal crops taken before seeding down and sometimes it has been reseeded direct. Two tons per acre ground limestone are applied before seeding down, 10 cwt. per acre basic slag at the time of seeding, and a further 10 cwt. per acre in the following autumn. Thereafter lime is applied as required and basic slag every second or third year. Reseeding is done with four-year leys, mostly of Aberystwyth strains, and as necessary these reseeded pastures are being ploughed and laid down again.

Analysis has shown that the soil is very deficient in phosphates, and on this account and because he considers it well worth while Mr. Morris does use very considerable quantities of basic slag. Normally potash supplies are satisfactory but Mr. Morris is beginning to use potash fertilizers where their use appears desirable.

The Open Hill In 1945 a start was made to plough the open hill, and the same policy of doing a moderate acreage each year and doing it well, was adopted. It was known that where bracken flourished good results would follow from reseeding, provided cultivations, manuring, management, etc. were correct, and so Mr. Morris started by tackling 8 acres; land where heather was predominant was a more difficult proposition, but in 1947 he dealt with 5 acres of this type of land. Following these trial runs, as it were, acreages varying from 16 to 48 were turned over annually, and now (in 1950) every part of the 167 acre hill has been ploughed.

Treatment of the land prior to reseeding has varied. On the four main sections dealt with this has been:

1. Plough
   Oats
   Rape
   Seed down

2. Plough
   Seed down direct

3. Plough
   Rape
   Seed down

4. Burn off heather
   Plough
   Rape (in 1950)
   Rape, or rye and ryegrass
   Seed down if fit

The land was ploughed 7–8 inches deep in autumn and winter and left in the furrow till the spring. It was then disced four times to get the necessary consolidation and a suitable seedbed. Four tons per acre ground limestone and 10 cwt. per acre basic slag were applied after discing (exceptionally 20 cwt. per acre was sown). The rape was sown with 2 cwt. per acre nitrogen fertilizer at time of seeding. The rape was then eaten off by sheep (30 acres fed 320 sheep in 1949).

After feeding off the rape, waste was ploughed in on a shallow furrow in the spring. If a second crop of rape is to be taken, 10 cwt. basic slag and 2 cwt. nitrogen fertilizer is again applied. After ploughing in the waste, the land is disced and rolled and the grass seeds sown. No fertilizer is given at the time of seeding, but 10 cwt. per acre basic slag is applied in the first autumn. Thereafter lime is applied as required, and 10 cwt. per acre basic slag every year. It is of interest that a soil analysis made in February, 1950, on the first portion reseeded three years before showed a lime requirement of 75 cwt. per acre ground limestone, phosphate moderate to low, and potash satisfactory. Experience with other hills in the district indicates the great importance of building up the lime and phosphate content of the soil by regular dressings.

Seeds mixtures used have varied slightly but the following is typical:

		lb. per acre
Italian ryegrass		4
Perennial ryegrass (Irish)		5
" "	S.23	6
" "	S.101	3
Cocksfoot	S.143	4
"	S.26	4
Red clover	S.123	2
White clover	S.100	1
Wild white clover	S.184	1½
		30½

On part of the area seeded down in 1950, a timothy mixture has been used.

Reference was made earlier to the greater difficulty of reseeding land covered with heather than that covered with bracken. Such fertility as exists is much lower on heather land, and frequently drainage problems arise. On the heather area under rape on Weston Farm in 1950, the crop was generally poor, but the common turnips sown with the rape have made satisfactory growth, and it might have been better to have sown common turnips only in the first year. Some time must elapse before this area can be fully productive.

Once established, the new grass, however good it may be in its first year, is dependent on after-management to reach and maintain full production. While clearly the regular application of lime and phosphates is called for, of equal importance is the way in which the grass is used. Grazing and resting should alternate, and stock, particularly sheep, should not be left on in the late autumn and winter. It is a good insurance against damage to grassland to have a suitable proportion of tillage on the enclosed land, to provide adequate winter keep.

A Policy that adds to our Meat Supplies

The ewes are Welsh and Welsh crosses and are mated to Clun rams to lamb down mid-March to mid-April. Wedder lambs feed off pioneer crops till Christmas and are sold off fat. Ewe lambs are kept for breeding. Some yearling ewes are sold, but the majority of the flock sales are of two-year-old ewes.

The cows calve in the spring and suckle their calves on grass throughout the summer. The young stock are kept on and sold when 18 months old. The best of the heifers are kept for breeding. The farm buildings at present limit the number of stock which can be kept, but plans are in hand for the erection of a covered yard, and this will enable expansion to take place. The aim is to maintain the ewe flock at its present numbers and increase the cattle breeding herd. Where in 1950 28 cows and heifers calved down, it

is anticipated that about 35 will do so in 1951, and it is hoped that it may eventually be possible to carry 50 cows and their followers.

Improvement of hill and upland grazings is not a simple operation. It is comparatively easy to reclaim bracken land, but once reclaimed it is important that all other factors should be geared to keep pace with improvements to the grassland, and the improvement effected has to be maintained. A considerable amount of drainage has been done at Weston, and several miles of fencing have been erected. The hill was divided into four plots and much fencing and hedging has been done on the enclosed land. The larger number of cattle which can be kept require the erection of a covered yard for young stock, and a Dutch barn for storing fodder; the greater activity brought about requires a certain amount of replanning of facilities. All this means a larger labour force, and considerable capital expenditure. Mr. Morris is fortunate in now being independent of hired labour, since five of his six sons are at home (the youngest has just left school).

The provision of additional capital is helped by the various subsidies and grants that farms of this type can qualify for or may be able to qualify for in the future. Weston Farm is a good demonstration of how the uplands can add to our meat supplies and it is typical of the enterprise which is being shown by farmers in the Clun area.

THE GLADIOLUS THRIPS – A PEST NEW TO BRITAIN

PAUL AITKENHEAD, B.Sc.

Ministry of Agriculture Plant Pathology Laboratory, Harpenden, Herts

THE earliest record of thrips destroying gladioli seems to be from Ontario, Canada, in 1929. Morison (1) named a species from carnations in Australia, *Physothrips simplex*, in 1930, and the following year Moulton and Steinweden (2) named in N. American material *Taeniothrips gladioli*, but the two were shown to be one species and the accepted name is now *Taeniothrips simplex* (Morison). The insect spread rapidly in the United States of America as far south as Florida and west to California. In the early 1930s it became a pest in British Columbia, in spite of strict quarantine measures to prevent its entry. In 1933 the Gladiolus thrips was recorded in Jamaica and Bermuda, and later in South Africa, the Argentine and Hawaii. The distribution of the species and the manner of its spread since 1929 suggest that *T. simplex* is either a sub-tropical insect or one adapted to a Mediterranean climate. It seems to be a recent introduction into Western Europe, the species appearing in large numbers in the Netherlands in the summer of 1949. The natural distribution of the known host plants supports this conclusion, for most of them are natives, or derived from native species, of West Asia or Africa, particularly South Africa. Gladiolus species do not occur naturally in Northern Europe, but some are native to the Central and Mediterranean areas.

T. simplex was first discovered on gladioli in Britain on July 29, 1950, in a Middlesex nursery (3); it was identified by Mr. E. R. Speyer of Cheshunt, and the Ministry's Plant Pathology Laboratory was informed. A survey of the nurseries in north-east Middlesex, undertaken by Mr. J. W. Bryden, showed that each of eight holdings examined had gladioli with typical thrips damage. Since it was then obvious that the pest was common in that area at least, the survey was discontinued and the measures at first contemplated

to destroy all infested gladioli were not pursued. All Provincial Advisory Entomologists were asked to keep a special look-out for the pest, with the result that thrips-like symptoms on gladioli were quickly discovered in many parts of the country and many identifications of *T. simplex* were made. Mr. E. R. Speyer, Dr. C. B. Williams and Dr. G. D. Morison gave invaluable help in this work.

The map records the appearance of the thrips in England and Wales in 1950* ; in addition, it was found at Pinwherry in Ayrshire. Very few of the outbreaks in 1950 appear to have been spread by breeding before 1950, although some nurserymen maintained that typical thrips symptoms had been observed in 1948 and 1949. It is impossible to predict the ability of this insect to perpetuate itself in different parts of the country under varying conditions of growing and storage, but that the pest can reach serious proportions in average summers is now evident. The weather and state of the soil at harvesting time and storage conditions seem to be important factors in its survival, and a study of the behaviour of the gladiolus thrips at these times is most likely to lead to cheap and effective control measures.

In addition to gladiolus, *T. simplex* breeds on Japanese and German Iris, Calla Lily, Poker Plant (*Kniphofia*), Montbretia (*Tritonea*), Tiger Flower (*Tigridea pavonia*) and Carnation (*). The adults visit many other plants in summer.

The presence of *T. simplex* should be suspected when symptoms as described below are found on any of the host plants. On gladiolus, all stages of *T. simplex* occur on the plant. The adult insect is small and slender, about one-thirteenth inch long, and is dark brown in colour with lighter bands between the segments of the abdomen. There often appears to be a broad pale band towards the head, but this actually consists of the bases of the forewings when at rest. The insect is active when disturbed and generally runs for shade. The larvae are orange-yellow when fully grown and paler when smaller. They are usually found congregated in the buds and, earlier in the season, on the leaves. If thrips are found on the corms *T. simplex* should immediately be suspected. Other species of thrips are often found on gladioli in summer, but only in the adult stage, so far as is known, with the possible exception of two predatory species. Certain of the occasional species do mark the flowers a little and the results may be mistaken for a light attack of *T. simplex*. Identification of specimens of the insects is essential in such instances.

Life History and Symptoms of Attack Where the host survives the winter readily, the gladiolus thrips will do so too, but in the Netherlands and most of North America the winter is too severe for its survival out-of-doors. In these circumstances the adults seek shelter, and conditions of cultivation allow them to move down in the autumn from the foliage to the corms, which are brought into the store. In order to feed, the insects must reach the flesh of the corms, either by crawling between the scales or by entering at the base round the junction of the old and new corms. If storage conditions are favourable, breeding takes place and the nucleus of the following summer's population is formed. The concentrated feeding that results may cause damage to the corms, especially if sprouting occurs.

Temperature is important in limiting breeding in winter. In experiments in the Netherlands and the U.S.A., it was found that at 39°F. eggs failed

* Further appearances since recorded are : Penrith (Cumberland), Charlbury (Oxford), Warfield(2) (Berks), Esher, Effingham and Hindhead (Surrey), Hanworth (Middlesex) and Rickmansworth (Herts).

to hatch and eventually died ; at 50°F. hatching took place but the newly-born larvae died after about three weeks. Development was quickest and mortality least in the range 70°–78°F. A. E. Herr (5) found that at 77°F. complete development from egg to adult took an average of twelve days, and at 59°F. about forty-one days. The eggs, which are very small and kidney shaped, are inserted in the flesh of the corm ; from these hatch small first-stage larvae about one-thirtieth inch long and translucent white in colour. These moult and reach the second stage, which is similar in appearance but less translucent, and finally turn the typical orange-yellow. The

Distribution of *Taeniothrips simplex* in 1950

Small dots = single records per locality
Large dots = multiple records per locality

fully-fed larvae change into the first pupal stage and then into the second, and lastly into the adult. At the pupal stages the insects are whitish, and very sluggish in their movements ; the rudiments of the wings are clearly visible. At the Laboratory they were found between the dry scales of the

corm quite separate from the larvae and adults. On growing plants they were almost always grouped on the shaded inside surfaces near the tips of the leaves.

The thrips are planted with the corm and as the shoot grows they are carried up with it, feeding on the leaves ; but later they crawl beneath the bracts of the young flower spike, where they feed and reproduce on the stem, bracts and buds, going through the same cycle as before. The thrips will spread rapidly through a crop, the spread being due at least partly to air-borne adults. Herr (5) considers that warm, dry summers are the most favourable to gladiolus thrips and that large numbers are killed by heavy rain. During the summer adults infest other plants and may breed on some of them. In autumn the population is greatly reduced by the weather, death of the plants, and migration, and only a very small number reach the gladiolus corms and return to store. In the Netherlands *T. simplex* cannot survive long on rubbish left outside in autumn, nor on corms left in the ground over the winter. Pupation in Australia (4) is said to occur in the soil in summer, but this has not been seen elsewhere. It is probable that conditions in this country in the winter are such that gladiolus thrips will not survive out-of-doors. Survival from year to year therefore is probably dependent on corm infestations.

Where corms are attacked patches of the surface cells become dry and turn grey. The patches spread with further feeding and later turn brown and rough. While the shoot initials are protected by their sheaths they are untouched, but should they form sprouts, then these and the rootlets may be destroyed, resulting in blind corms. On the growing plant the signs of feeding are a streaky silvering of all green parts and mottling of the petals in bud and flower. The silvered parts may turn brown later, but this is not usual while the plant remains green. In severe attacks the flowers may become so dry that they wither and fail to open. A typical example of a flower thus spoiled is shown in the art inset. Some leaf mottles and streaks, and colour breaking in flowers due to other causes may be mistaken for thrips damage. Broken colours can easily be distinguished from thrips damage by holding a specimen petal to the light ; areas mottled by thrips then appear much more transparent than even the palest colour in a mixture due to other causes. The pale, wet areas of *Botrytis* attack on the flowers can readily be distinguished by their wetness and more regular shape, even though they, like thrips markings, allow more light through than do healthy tissues.

Summer Control The earlier sprays were based on tartar emetic or Paris green and other arsenicals with brown sugar, and dichlorethyl ether. Of these, a mixture of tartar emetic and brown sugar gave reasonable control, and did not damage the foliage or flowers. More recently DDT, BHC, HETP, parathion and chlordan, as sprays, dusts and aerosols, both separately and in mixtures with other insecticides, have been tested in the U.S.A. (7), Australia (4), and other countries. Although tests have not, on the whole, been very extensive, the most successful of these sprays appear to be a BHC emulsion containing 0.1 lb. gamma isomer, and a chlordan emulsion containing 0.5 lb. active material, per 100 gallons water.

In the U.S.A. HETP gave rather poor results. In Australia, at the present time, 0.1 per cent DDT emulsions, e.g., 3 fluid oz. of 20 per cent DDT emulsion to 3¾ gallons water, are in general use. To obtain good control, spraying must begin early. The first application should be given when the plants are about 6 inches high. Except for DDT aerosols, none of the insecticides used caused flower or foliage damage. The poor results given

by HETP are probably accounted for by its poor persistence. An emulsion with good spreading and sticking powders is best, and when spraying, run-off should be avoided as far as possible.

In Middlesex a DDT spray containing 5 oz. 20 per cent DDT wettable powder and ½ pint of summer oil in 6 gallons water failed to save a flower crop or prevent infestation of the corms when applied ten times between the end of July and mid-September. The wettable powder used left a deposit on the leaves and flowers but had no phytotoxic effect. At Bristol, applications of a DDT emulsion were a failure. However, both these attempts were handicapped by the late start made.

Winter Control The methods for winter control may be divided into three classes : fumigants, dips, and miscellaneous. The general aim should be to free the corms of thrips before planting them. The oldest and best-known method is fumigation with naphthalene ([5],[8]). After the corms have been dried and cured for about a month, ½–1 oz. of grade 16 naphthalene is mixed with each 100 corms in shallow trays, boxes, or paper bags, in a fairly draught-free store which can be heated ; tight containers should not be used because they might stimulate sprouting. Where serious draughts cannot be avoided, up to 1½ oz. naphthalene per 100 corms may be applied.

The temperature of the store is held at between 70° and 75°F., in which range fumigation lasts for eighteen to twenty-one days. After treatment, the temperature is reduced to about 50°F. and the corms are well aired for at least one month before planting. It is claimed that all stages except the egg are killed, and since the eggs quickly hatch at the high temperatures used, the resulting young soon die. Sprouting corms should not be fumigated because the sprouts are damaged if they are formed before, or at the beginning of, fumigation.

Other methods involving the use of methyl bromide and calcium cyanide require air-tight chambers, and, because of their extremely poisonous nature, these chemicals should be handled only under expert guidance. Steinweden and others ([9]) fumigated corms with methyl bromide as follows :

Dose per 1,000 cu. ft.	Duration *hours*	Temperature *deg. F.*
12 oz.	5	70
1½ lb.	3	70
2 lb.	3	80
3 lb.	2	80

The authors state that the relative humidity should be at least 60 per cent during exposure, and that the temperature of the corms, as well as of the chamber, should be 70°F. when treatment begins. Thrips at all stages were killed by all the treatments. The last of these caused some stimulation of growth and earlier flowering ; the others had no apparent effect.

Wilson ([10]) reports that the use of powdered calcium cyanide (44 per cent active material) at the rate of 3 oz. per 1,000 cu. feet killed the thrips at all stages except the egg. Repeating the treatment after a ten-day interval generally eliminated the thrips.

Dips consisting of mercuric chloride (corrosive sublimate), warm water, and parathion have so far been tested. Mercuric chloride solutions have been tried for the control of thrips, scab and *Botrytis* and certain other rots of gladiolus corms. Mercuric chloride has given variable results as a fungicidal dip for corms in store and as a pre-planting dip to protect the crop from diseases ([2],[13]) ; on the other hand, this treatment has given good

results against thrips. It should be applied early to prevent thrips damage in store, and because dipping just before planting may check later growth. MacKenzie ([11]) suggests immersing of unpeeled corms for seventeen hours in a solution consisting of 1 oz. of sublimate to 6 gallons of water ; and List ([6]) mentions eight to twelve hours in a solution containing 1 oz. of sublimate in about 6½ gallons water for unpeeled corms, and four hours if they are peeled. More sublimate should be added after each immersion to maintain the strength of the dip. It should be remembered that corrosive sublimate is a dangerous poison and corrodes all the common metals, so that it must be handled very carefully, in earthen, wooden, enamelled or glazed containers.

MacKenzie claims also that thrips can be eliminated by immersing unpeeled corms for 20 to 30 minutes in warm water at 112°–114°F. It is, of course, necessary to dry corms afterwards ; but he does not state whether the treatment itself can safely be given before the normal drying-off process.

Of the remaining methods of control, dusting the corms with 5 per cent DDT is now officially recommended in the U.S.A. ([14]). The dust is sprinkled over the corms at the rate of 1 oz. per bushel in trays, or one teaspoonful per 100 corms in paper sacks, as soon as possible after harvesting. If treatment is delayed the thrips will be protected by the scales and control will be poor. Research into the effect of removing or chemically killing the tops, together with treating the soil and stumps before lifting time, might result in finding a simple method for preventing the thrips from colonizing the corms.

It is not known how quickly the thrips will spread in store ; but even if the spread is slow indoors in winter, it can be swift in summer, so that it is obviously important not to mix clean and infested stock in store or in the field.

Summary The life history of *T. simplex* in this country is probably the same as that in Holland ; gladiolus thrips probably cannot survive the winter out-of-doors in our climate and therefore their survival from year to year is probably dependent on corm infestation. The main symptoms of damage in summer are silvering of all green parts, and mottling of the flowers, beginning in the bud stage ; and on the corms, similar patches of silvering which later turn brown and rough. Control measures in summer are not effective unless begun early and carried on until flowering. The most effective methods are likely to be those which eliminate the thrips on the new corms.

Thanks are due to Dr. J. G. ten Houten, Director of " Instituut voor Plantenziektenkundig Onderzoek " for a leaflet on gladiolus thrips and much useful information on the biology and control of *T. simplex* in the Netherlands ; to entomologists and horticultural officers of the N.A.A.S. for material and details of infestations ; and to Mr. Buck for the photographs.

References

1. On a Collection of Thysanoptera from S. Australia. Morison, G. D. *Bull. ent. Res.* 1930, **21**, 12.
2. A New Taeniothrips on Gladiolus. Moulton, D. and Steinweden, J. B. *Canad. Ent.* 1931, **63**, 21.
3. The Gladiolus Thrips. Skillman, E. *Gdnrs. Chron.* 1950, **120**, No. 3, 182.
4. Notes—The Gladiolus Thrips. Entomological Branch. *Agric. Gaz. N.S.W.* 1950, **60**, 297–300.

5. The Gladiolus Thrips (*Taeniothrips gladioli* M. and S.). Herr, A. F. *Bull. Ohio agric. Exp. Sta.* No. 537, 1934.
6. The Gladiolus Thrips in Colorado. List, G. M. *Circ. Colorado State Coll.* No 64, 1935.
7. DDT and Other Synthetics for Control of Gladiolus Thrips. Smith, F. F. *J. econ. Ent.* 1948, **41**, No. 6, 955–9.
8. Private communication. Houten, J. G.ten. 1950.
9. A Single Treatment for Gladiolus Corms to Destroy all Stages of the Gladiolus Thrips. Steinweden, J. B., Mackie, D. B., Carter, W. B. and Smith, S. S. *Bull. Dept. Agric. Calif.* 31, No. 1, 1942.
10. The Gladiolus Thrips in Florida. Wilson, J. W. *Bull. Fla. agric. Exp. Sta.* No. 357, 1941, 3–22.
11. Life History and Control of the Gladiolus Thrips in California. MacKenzie, H. L. *Circ. Univ. Calif. Agric. Exp. Sta.* No. 337, 1935.
12. Diseases of Bulbs. Moore, W. C. *Bull. Min. Agric.* No. 117, 1939, 98–120.
13. Abstracts in *Rev. app. Mycol.* 1948, 476; 1949, 399, 455; 1950, 306.
14. Gladiolus Thrips. Picture Sheet. No. 6. *Bur. Ent. and Plant Quar. U.S.D.A.* 1950.

PROFITABLE POULTRY ON THE GENERAL FARM

Hugh R. Finn

Nackington Farms, Canterbury

SINCE the war there has been a considerable increase in commercial egg production on the general farm all over the British Isles—especially in areas where small farmers are keeping poultry as their main type of livestock. Perhaps it is worth investigating why this has happened. Between 1930 and the outbreak of war it was possible to buy feedingstuffs very cheaply in unlimited quantities. From personal experience as a general farmer who kept poultry at that time, I can say that it was better for us to buy feedingstuffs rather than try to grow them, and the only way we could make any sort of living out of our arable land was by producing vegetables on a field scale and herbage seeds peculiar to our part of East Kent. It does not need me to tell you that the position is now completely reversed. Feedingstuffs are still scarce; they are very dear indeed and it undoubtedly pays the farmer to grow all he can to feed his own livestock. Hence this marked increase in commercial egg production in the hands of the general farmer and away from the specialist poultry-keeper.

Possibilities for the General Farmer I am not one of those people who believe that egg production can be carried out efficiently only in the hands of the specialist, but I do readily agree that many general farmers are not making the best use of the feed they have available by turning it into the greatest possible number of eggs. I have many friends, experts on poultry-keeping, who say that the only chance of success in the future is to keep laying birds intensively, in batteries, deep litter houses or possibly henyards in the warmer parts of the country. On the whole I am inclined to agree with this view, since with our short winter days it is essential to light birds artificially to maintain production, and the economic pressure of labour and food costs makes high egg production essential. Although intensive systems may need more capital outlay, it is better to find more money in the first place and make a profit than to make do with inadequate

equipment and make a loss. Much of the increase in commercial egg production on general farms has taken place in Northern Ireland, Scotland, particularly in Aberdeenshire and in parts of Wales. These are districts where small family farms predominate, paying out no weekly wages and therefore having low labour costs, and I am fully aware that it is the practice to keep their small flocks either on free range or in fold units, and in stressing the value of intensive poultry-keeping, I want to make it clear that I am thinking in terms of flocks of 300 or more.

The other main contributing factor is the necessity of producing most of the annual output of eggs during the autumn. At the moment the average egg price is 4s. 1d. a dozen throughout the twelve months, but if most eggs are produced in the spring the average return for the year is below this figure and, of course, if high autumn production is achieved a better return can be secured. I have heard of a successful deep litter plant which produced an annual average of 4s. 2¼d. a dozen owing to high autumn egg production, and, as previously mentioned, artificial lighting can help to achieve plenty of autumn eggs. The average egg price in 1951, it is anticipated, may be lower, and so it will be even more important to produce autumn eggs.

With these factors as a background to the present situation, it is clear that the general farmer has a number of fundamental problems to get over if he is going to produce commercial eggs and make a profit at it. First of all, he must provide himself with sufficient food of the right type at the right cost. Second, he has to keep his birds under conditions that will enable him to reduce labour costs to the very minimum and, at the same time, be sure of a good output during the autumn. None of this can be achieved without some experience both on the part of the management and the staff who are looking after the birds, and the capital outlay is bound to be considerable.

Housing : Converted Farm Buildings It is probably best to study the question of the type of housing to use in the first place. There are many farm buildings up and down this country still not being put to the best use. In many cases they could be converted into deep litter houses merely by the addition of a few windows here and there and by making sure that the floor and walls are sound ; the great thing to avoid with any birds kept indoors is draughts. On the other hand, suitable ventilation is essential. When, however, it comes to deciding whether one of these buildings could be used as a battery house, it is wise to be much more cautious, as it is more difficult to find a building which is suitable for conversion for this purpose, as every detail counts. In the first place, greater height of the eaves is necessary and a much more efficient type of ventilation, although both for deep litter and batteries a well-insulated building is essential. Birds will never give of their best unless they are living in an equable temperature. Besides the eaves' height and ventilation, the building must be dry, have enough width in relation to its length and have good access to enable food and droppings to be transported easily and cheaply. The capital cost today of building a new battery house is at least £2 a bird, and the cheapest cages which are of any value usually cost £1 a bird on top of this. I have known converted battery buildings costing about £1 a bird, thus saving £1 in costs over erecting a new one. In the case of deep litter houses there is much more opportunity for the cheap conversion of farm buildings. I have known cases where, without internal equipment, it has been as little as 5s. to 7s. 6d. a bird, and that, to my mind, is why the deep litter system has a promising future.

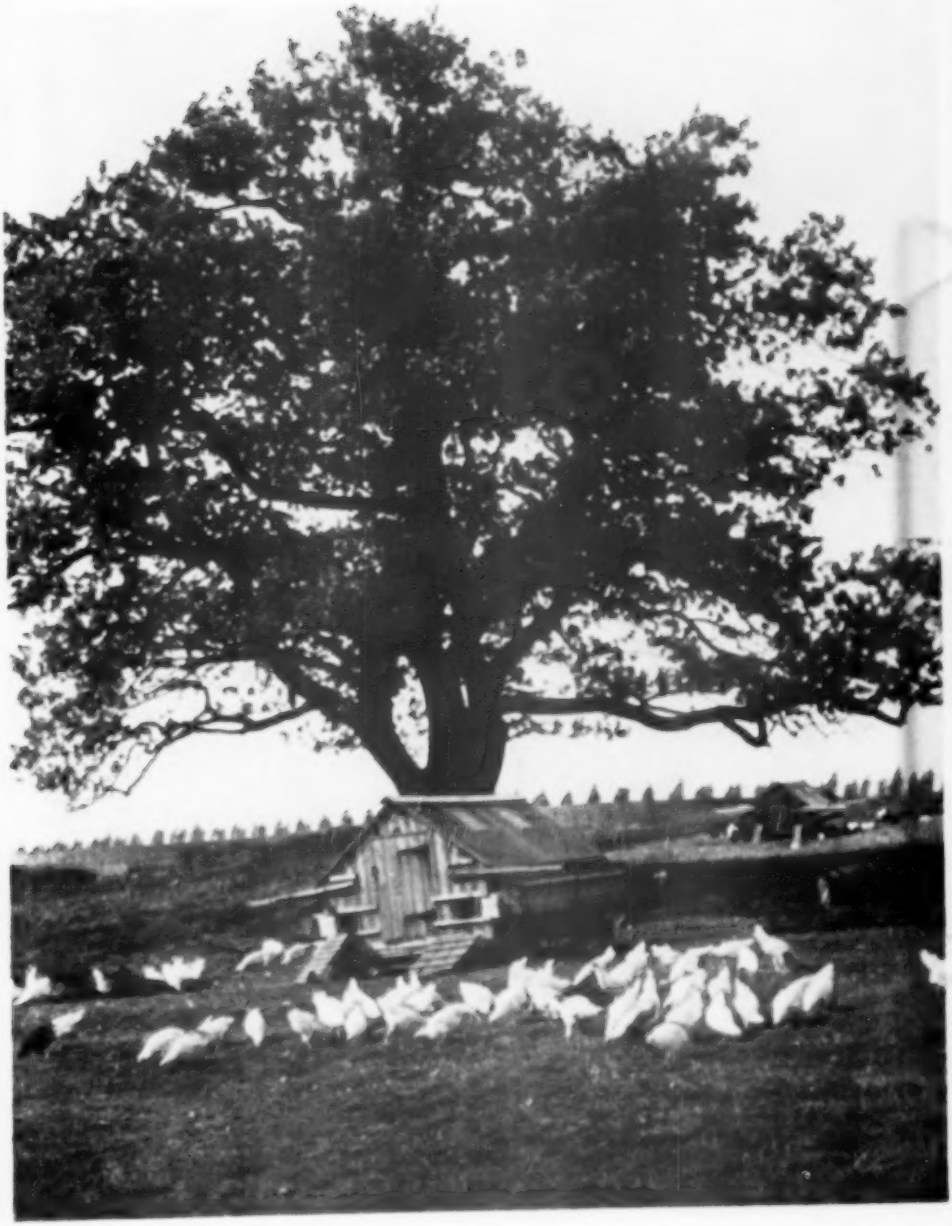


Photo : A. C. Moore

Control plot (centre) at the time of the third cut

Typical plants: *(left)* from control plot, *(right)* from plot receiving 4 cwt. muriate of potash

Close up of control plot

Close up of plot receiving 4 cwt. muriate of potash annually

Leaf damage by gladiolus thrips, showing silvering

Mottling of flowers, withering of petals and silvering of bracts and stem

From what I have seen of henyards in my district, I think they have a future, but I would give this one word of warning : I believe there may be some difficulty in getting autumn egg production in a very severe winter like that of 1946-47, and it is for this reason that I believe the system to be more suited to the southern and eastern parts of the country. The choice then will depend largely on whether a suitable building is available for conversion, either for deep litter or battery use. There are, of course, many general farmers still producing commercial eggs successfully either in fairly large colony houses on free range, small portable houses moved round their leys, or fold units. It would be foolish to argue that these systems have no future ; I think they have where weather and geographical conditions are suitable, but I am fully convinced that the profit per bird will, with good management, be best where birds are kept intensively.

Food related to Egg Production Turning to feedingstuffs, the problem that every general farmer is faced with when it comes to providing a suitable ration, is first a lack of animal protein, fishmeal or meat meal ; 10–12 per cent is essential to produce eggs during the winter months, and I think it can be accepted as a fact that while vegetable proteins, particularly dried grass, have their value, animal protein is absolutely essential. A lot of scientific work is being done on the value of the different amino acids which go to make up the present protein foods we use ; no very suitable substitutes, however, have yet been found. This is not the only difficulty. On ordinary national mash a hen consumes between 120–130 lb. of food per year ; pre-war this was about 112 lb., so we have to face the fact that to get the eggs we have to feed more of this expensive food per hen. The general farmer today mainly lacks good roughage ; by this I mean mids and bran which before the war constituted approximately 40 per cent of the normal poultry mash. When the general farmer gets down to mixing a home-grown mash he must realize that it has to be fed in a balanced form, should not be varied too much (certainly not too frequently as it will upset the birds) and must not only have the right analysis but also be of the right bulkiness. The following ration is used by a friend of mine :

	parts
White fish or meat and bone meal	1
Protein concentrate	1
Grass meal at 17 per cent protein	2
Sharps	2
Molassed meal	1
Wheat	1
Barley	5
Oats	6

He is able to pellet his mixture, which I believe to be a great advantage. It is very important to avoid changing from mash feeding to pellet feeding during the autumn. Birds used to mash feeding will not eat pellets readily, and if pellet feeding is to be adopted they must be fed at rearing stage and on. The fact that my friend has access to good quantities of dried grass or lucerne meal as well as cereals is, of course, most useful. This mixture, costing about £23 per ton, is at least £8 and possibly £9 a ton cheaper than the national mixtures, even charging the home-grown corn at the feeding market prices. To my mind this is where the general farmer sets out with a tremendous advantage in the competitive business of producing profitable eggs.

It is easy enough to produce a few spring eggs from a flock of birds kept round the farm buildings (many hundreds of thousands of hens are kept in

this way up and down the country) but when it comes to the difficult job of averaging more than 150 eggs per bird, management plays a special part in the business. All experts are now generally agreed that a hen house average of less than 150 eggs per bird is unprofitable. Good housing, proper food and management are, you will remember, the things that count. The birds, run on free range even in fold units, can help themselves a good deal, particularly with food ; intensively housed poultry are completely dependent on what is set before them. To my mind it means that of all types of livestock production that a farmer takes in hand, this one is the most difficult to do properly, and I would suggest that any farmer who now keeps poultry owes it to himself to keep an account of the expenses involved by way of labour, feedingstuffs, repairs and renewals, etc., compute what interest on capital he has to find and set that against his return for eggs. I fear that in many cases he will find he is losing a surprisingly large sum of money each year. We know that this situation arises not only here but in America, where on the family farms of the Middle West, 200–400 birds are often kept for pin-money, just as in England—but it is expensive pin-money all the same. One of the "musts" of poultry-keeping then is to keep accurate records of costings.

The man or woman who looks after poultry must have some stock sense ; overfeeding is as easy as underfeeding. Regular and careful attention is essential, and when the margin of return over expenditure is narrow, small labour items may very easily tip the balance.

Cross-Bred Chicks By now you will be saying that it is all very well to talk about keeping up a high average egg yield and stressing management and housing, but what about the stock ? That, of course, is a cardinal point. The general farmer, like everybody else, has to buy birds which will have the potential capability of producing the eggs which his management should obtain. I think the Ministry of Agriculture Accredited Scheme goes a long way towards providing the answer. Buy cross-bred day-old or growing pullets from either an accredited breeder or an accredited hatchery. The quality of stock will vary, I admit, but I think you will be satisfied. If you find that you are not, get in touch with your Poultry Advisory Officer and tell him ; in this way you are not only doing yourself a good service but also the breeder or hatchery concerned, since it helps them to know that they have to put their house in order.

Hybrid vigour obtained by crossing two pure strains is an extremely valuable way of getting sound stock, and that is why I say cross-bred chicks every time. It is for you to decide whether you prefer to rear from day-old or to buy growing birds, according to whether you are prepared to lay out the extra capital on rearing equipment or, more important still, whether you have the right balanced food and somebody to look after the chicks. It is, of course, cheaper to buy day-olds—the rearer has got to make a profit—but it is cheaper only if you can make a good (or better) job of rearing than the professional. To buy day-old pullets at 3s.–3s. 6d. apiece and spend about 10s. on rearing them to maturity and then find that because you have a serious outbreak of coccidiosis only half of them are any good to go into the laying-house, makes them a much more expensive proposition than if you had bought well-reared birds at, say, 16 weeks old at £1 apiece. In rearing it is not always the deaths which are financially so serious ; it is the after-effects of one or other of the many diseases which poultry can get when growing up which can be so costly, particularly so because only an experienced poultryman can tell whether birds affected in this way are

worth housing or not, and quite the most expensive mistake to make in poultry-keeping is to house and feed non-productive hens.

Keep Accurate Records Finally, to those of you who have not yet started, I would say go in for an intensive system every time, particularly if you have a building which the N.A.A.S. tell you could be easily converted. To those who are making a go of it already by one of the many other methods available, I would not think of changing at this time. Remember that you have to farm at least to some extent for poultry, both to produce the food and environment most suitable for them. Mixed corn with as much wheat as possible in it is a great asset these days and if the birds want free range or are in fold units, they are much better going round on fresh leys rather than staying always in the home meadow. I compute that you will have to produce an average of 150 eggs per bird per year, half of these in the months from June to December, to break even on your poultry section.

The following balance sheet helps to prove my point :

Estimated Balance Sheet for Birds kept in Batteries

	s. d.	£ s. d.
Costs per bird per year		
Interest on capital @ £3 per bird and depreciation ..		6 0
Labour		3 0
Purchased feedingstuffs *125 lb.		1 15 0
Cost of rearing hen (Bought £1)	15 0	
Less : market value dead	7 6	7 6
		2 11 6
150 eggs at 4s. 1d. per doz.		2 11 0

* Home-grown 25s.

From these figures you can see how necessary it is to keep accurate records of egg production. A small variation in the number of eggs laid per bird housed means a profit or loss. It looks as if the general farmer has the advantage of about 5s. per bird per year in lower food costs by growing his own requirements—a very big consideration these days. In computing these figures I have obtained information from many different sources, and although these are approximately an average, I would say that the interest on capital would be lower for free range or fold unit types of housing and possibly for deep litter. On the other hand, the amount of food used would be greater with intensive housing thus putting the cost up ; labour would be a higher charge with the outdoor systems but whichever way you look at it you are bound to come back to the problem of the hen house average, and there is no doubt whatever that if this is much below 150 eggs per bird there is little if any profit to be made where ordinary labour charges are incurred—a factor which is so very often not taken into account on the small family farm.

FARM ROADS

B.B.C. Home Service Broadcast, December 21, 1950, by R. R. Ware M.A. (Oxon.), F.R.I.C.S., F.L.A.S. Director, Agricultural Land Service

LIKE most other farming problems, there is no straightforward answer to the problem of the private farm road. Unfortunately, good roads are very expensive—so expensive that it is just not practical to say, "if you want a road build the best and forget the expense". The problem has to be approached from the other end: "Do the least you can to keep out of serious trouble."

Every farm road problem is an individual one. Perhaps you have a road which serves your farm pretty well but, built before the days of motor traffic, it is now being knocked to pieces by lorries. Perhaps there is no hard road to your steading, or if you have one to the steading, there isn't one to those parts of the farm where it is wanted for leading on manures and leading off crops. If you have a road already the chances are that it will be cheaper to make it up than build a new one. Macadam, the great road engineer, said that it was the native soil which really supports the weight of traffic. "While it is preserved in a dry state," he said, "it will carry any weight without sinking." The two important things about road-making, therefore, are to make sure that the road has a good soil underneath it and then keep that soil dry by keeping water off, and out of, the road itself. Some soils are better than others, of course; a chalk or a rock bed, for instance, is better than one of clay or soft loam. Underground springs or faults may be a source of trouble, and where an old road has stood the test of time it is fairly certain that there will be no worries of that kind.

Keep Water Off the Road The first thing to do with an old road is to see that water does not scour down it or stand on it. Nothing destroys a road quicker. Storm water must be intercepted by grips or by tile drains, and the surface of the road should be made up by stoning to a height above that of the verges, and cambered so that water runs off it instead of standing on it. If the land is flat the water-table must be kept down so that what Macadam calls the "native soil" beneath the road is above the water-table at all seasons. Usually the camber falls to both sides of the road, but a straight cross-fall from one side to the other may be found more convenient on hillsides or on curves. It doesn't really matter as long as the water is got off quickly and not allowed to stream down the length of the road.

Clean, hard stone or rubble is the best road-making material, and ideally, it should be broken to a size that will pass through a two-inch ring so that it will consolidate well. Sharp stuff is better than round for the same reason. But the really important thing is that the material should be cheap—which means that it must come from the nearest suitable source. You may need a lot of it and the cost of a long haul will prove prohibitive. I have seen useful farm roads made from rubble from old buildings, from old cracked-up concrete, and even from stone thrown out by a gyro-tiller. Slag, chalk, gravel, clinker, flints, can all be used as road-making materials.

The ideal road surface is waterproof; 2½ inches of tar macadam can be laid on the surface of a road with a top dressing of sand and tar or cold bitumen at a cost of roughly 5s. a square yard. If the road is top dressed again at the end of the first year it should give very little trouble for ten or fifteen years thereafter. I know that some people say that tar macadam is not good stuff for a road which is open to stock; it is difficult to get

actual evidence, but as far as my experience goes I would say that very little damage will be done if the surface is close and waterproof. Tar macadam is perhaps not ideal stuff for stockyards, as in hot weather it may get pitted with hoof marks—but it will stand up all right to any use it will get as a farm road if the surface is dense enough to prevent washings from cow droppings and urine penetrating.

There are other methods of waterproofing the surface. There is a preparation on the market which can be mixed with a cement grout and which will form a surface like concrete. Where traffic is not heavy, an old-fashioned water-bound surface made by "blinding" the surface with fine material may prove effective, but it does not stand up too well to fast or heavy traffic and it is difficult to keep it from getting dusty in dry weather and muddy in wet. A waterproof surface, such as can be given by tar macadam or cement grout, will make a more lasting job, but if the expense is not justified you will have to make do by more frequent making-up. The great thing, however, with an existing road is—*keep the water off.*

New Roads and Their Cost The route for a brand new road should be chosen carefully. It should be the shortest possible, so as to save expense, not forgetting, however, that you want to pick up as many fields or other important points on the farm as you can. It should have a firm subsoil as a bed, and cuttings or embankments should be avoided like the plague, as they are expensive to make and maintain. The gradient need not cause too much concern. In days when traffic was horse-drawn this was most important, but motor traffic can tackle any reasonable gradient without fuss. Avoid right-angles or sharp corners. As to materials, if the road has to take a lot of fast and heavy traffic, there is nothing to beat a concrete road—but it is an engineering, or at any rate a contractor's, job from the start, and very expensive. Besides this, cement for road-making is not too easy to get hold of nowadays. If a concrete road is decided upon, make a good job of it; it is much too expensive to risk mistakes. Concrete roads that have been badly laid are very difficult to get right afterwards, so if you make a concrete road—and some farmers do make them quite successfully with their own labour—get good engineering advice and see that the work is properly supervised. The extra expense on what is a major capital outlay will be justified.

As to the width of the road, the narrower it can be made within reason, the cheaper it will be. Nine feet should be wide enough for all farm purposes, if you provide passing and turning places; and don't forget to give extra width on curves for vehicles with long wheel bases.

If you cannot afford a concrete road, or think the expense is not justified, you may be able to make a traditional type hard stone road with materials which can be obtained fairly easily. Such a road will cost less to start with, but more in repairs later. It requires a good foundation of stone pitching or hardcore with smaller broken stone on the top, and a surface of tar macadam or cement grout or blinding material according to your needs and purse. An old-fashioned method of construction in certain districts was to put a one foot layer of heather bundles or brushwood above a bottom layer of hardcore. This was covered with road metal and, when rolled, compressed to about 4 inches. I saw a road being made in this way in the New Forest a few months ago. It saves some hardcore, spreads the load and gives the road a flexibility which is useful on a soft soil.

The cost of a new road will depend largely on how near you are to the source of your road-making material. A well-made concrete road 9 feet wide may work out at £4,000-£5,000 a mile. A stone and tar macadam road

should be cheaper, perhaps £2,000 a mile—but it may be cheaper still if you are lucky in having materials near at hand.

If the road is needed only for occasional use, even a stone one may be too expensive. The Dutch are great road-makers, and for light farm traffic they sometimes use a road made simply of sand. Such roads are, however, 20 feet wide or more, so that each vehicle can take a different route, the track of one vehicle filling in the ruts made by another. A farmer I know gets off his heavy crops each autumn by simply bulldozing out and rolling an earth track. He is fortunate in having a reasonably dry climate and soil, so that in his case it is probably the cheapest solution, but I must find out how he has got on this autumn!

Some people use concrete ribbons or wheel tracks filled up with loose stone. If traffic is not too frequent it is a possible half-way house—but like most compromises, it is not altogether satisfactory. The concrete strips should be not less than 2 feet wide each and 9 inches deep. In a chalk country a very fair road can be made out of a foot of block chalk with a top dressing of gravel well rolled down. Concrete curbs to prevent the chalk spreading will give better consolidation. Chalk gets slippery when wet, hence the gravel top dressing; also it is subject to frosting, but it will make a fairly good road for light farm use. If you live near a power station, ashes and still more ashes may be the best answer, though I was talking to a farmer only last week who gave up ash roads because he found that many of his cows which travelled the road daily went lame. But not all farm roads are built for dairy herds.

In other parts of the world, hard roads are made out of the soil itself. They call it soil stabilization. It can be mixed with some hardening or grouting preparation which will make a good surface. Experiments are going on in this country and I have seen farm roads made that way—but it is a tricky process, requiring laboratory soil tests. In our variable climate and with our extraordinary variation in soils, the process has not yet been fully worked out; it must still be considered as in the experimental stage only. But it may provide an answer some day.

It seems to me, therefore, that there is no single answer to road problems. Traffic needs must be balanced against your purse. Perhaps the solution in some cases may not be more roads, but caterpillar vehicles. The only advice I can give is, keep the water and your tractors (unless they have rubber tyres) off what roads you have, and make the best use of whatever road-making materials are nearest to hand.

ARTIFICIAL INSEMINATION

International Bibliography

The Institute for Artificial Insemination in Milan is proposing to publish in the spring an international bibliography on artificial insemination.

The Institute invites all technical officers to assist in the compilation of this bibliography by supplying either copies of any books they have written on the subject or, alternatively, full details of such publications. Books or information should be sent to the Director of the Institute, Via Flli, Bronzetti 17, Milan, Italy.

VEGETABLE SEED PRODUCTION IN HOLLAND

C. North, B.Sc., N.D.H.

National Institute of Agricultural Botany, Cambridge

DURING the last few years vegetable growers in Britain have become more aware of the advantages of sowing the best seed available. At the same time British seed growers, alarmed at the rising demand for imported seed, are realizing that to maintain their present status they must produce seed of a quality superior to, or at least as good as, any that may be produced overseas. In view of this rising interest in seed quality, a short visit to Holland was planned for the summer of 1949 to study the vegetable seed-growing industry there, and in particular the means employed for maintaining and improving seed quality. The following brief summary of the Dutch industry is based on information obtained during that visit.

It is frequently assumed that Dutch summers are warmer and drier, and thus more favourable for seed production than ours, but an examination of meteorological data does not bear this out. Average summer temperatures for Holland and eastern England are much the same, but on the whole winters are more severe in Holland than in most parts of the British Isles. Even in Walcheren Island, which enjoys a more maritime climate than any other part of Holland, heading broccoli may be grown with a reasonable chance of success only if the plants are overwintered under glass.

The mean annual rainfall throughout Holland lies between 25 and 28 inches, but for many parts of the eastern counties of England the corresponding figures are below 25 inches. For Essex, which produces about 60 per cent of Britain's home-grown vegetable seed, the average yearly rainfall is only 19–22 inches. Moreover, the maximum monthly summer rainfall of about 2½ inches falls during July in Essex, whereas an average of 3–3½ inches falls in Holland during August, when the majority of vegetable seed crops are ripe for harvest.

Seed Acreages Records published in the annual reports of the Seed Production Committee show that the acreage devoted to vegetable seed crops has, at least since 1943, been greater in Holland than in Britain. The difference, however, has not always been as large as popular opinion supposes: for example, when in 1948 Holland grew some 26,000 acres of vegetable seed crops, approximately 20,000 acres were grown in Britain. Much larger acreages are devoted to dwarf bean, radish, and spinach seed crops in Holland than in this country, but it is not generally known that a greater acreage of brassica and green pea crops has been grown in Britain than in Holland during recent years.

The most concentrated area of vegetable seed growing in Holland lies in the province of Noord-Holland, bordering the north-west coast of the Zuider Zee. The district around the town of Enkhuizen is one of the oldest seed-producing areas in the country, and at the present day many of the larger seed firms have their headquarters there.

Groningen province in the extreme north of Holland has produced large quantities of radish, spinach, and pea seed in recent years, and as a vegetable seed-growing area now ranks second in importance to Noord-Holland. Other seed-growing areas are scattered mainly over the eastern provinces of Holland—in particular, the islands of the Scheldt.

An Official Guide and Inspection Service

In 1943 the Horticultural Plant Breeding Institute at Wageningen generally known as the I.V.T. (*Instituut voor de Veredeling van Tuinbouwgewassen*) published a descriptive list of vegetable varieties. The original work has been revised twice since its introduction, and research on the classification and identification of vegetable varieties is still in progress. This list describes the distinguishing features of nearly all varieties cultivated in Holland, and comments on their value from a horticultural standpoint. Certain varieties and strains which have been shown to be of particular merit are given official recommendation. Not only has this guide proved of great assistance to the market grower in helping him to choose the varieties most suitable for his particular requirements, but it has also provided a basis for the standardization of nomenclature and, as a result, synonyms are now used only to a very limited extent in Holland.

An inspection service for vegetable seeds popularly known as the N.A.K.-G. (*Nederlandsche Algemeene Keuringsdienst voor Groentezaden*) was started in 1941. Membership is compulsory for all seed firms, wholesalers, exporters and retailers of vegetable seeds. The service is financed entirely by members, and is governed by a board representing all interested parties. The *ex-officio* chairman of the Board is the Director of Horticulture of the Netherlands Ministry of Agriculture, Fisheries and Food.

Inspection of all stocks of vegetable seed for varietal purity and authenticity, based on the official descriptive list, is the main function of the N.A.K.-G. Bags of seed shallots and onion sets are sealed and given a certificate if they satisfy the inspectors, but for true vegetable seed the N.A.K.-G. gives no form of guarantee after inspection. If, however, any stocks do not reach the required standards, the service may prevent their further multiplication, or demand that they are destroyed.

Inspection is directed primarily to the stock seed crops. A high proportion of these are inspected in the field by the N.A.K.-G's nine permanent inspectors and some eight temporary inspectors (enlisted for the summer only) but most of the larger firms are permitted to inspect the greater part of their crops themselves. Samples of seed from all stock seed crops have to be sent to the service's trial ground at Rijswijk for growing-on tests. Check inspections are made on a proportion of the commercial seed crops, and crops destined for export. The latter are sampled and sealed by the N.A.K.-G. inspectors, and the samples are subjected to growing-on tests. In addition to these inspections, check samples from some retail stocks are grown on for examination.

The Central Offices of the N.A.K.-G. are situated at the Hague, where the Director, Ir. J. Siebenga, has his headquarters. The trial grounds at Rijswijk, seven miles from the Hague, cover about 7½ acres, and it is here that some 10,000 samples are subjected to growing-on tests annually. A staff of two technical officers, a foreman and two men maintain the trial ground. Other functions of the N.A.K.-G. include the administration of zoning schemes, collection of all figures relating to seed production of vegetables, publication of a fortnightly journal for members, and the provision of a seed-testing service. Advice on cultural matters relating to seed production is not undertaken by the N.A.K.-G., this service being given by the Government's provincial Horticultural Advisory Officers.

Isolation and Testing of Seed Crops

In 1948 minimum distances were prescribed for the isolation of certain seed crops to prevent contamination of stocks through cross-fertilization. Seed growers are legally bound to observe these distances. Not only are minimum

distances laid down for different varieties of the same crop, but for many kinds minimum isolation distances are prescribed for different strains of the same variety. It is interesting to note that a distance of 1,000 metres is required between red and white-skinned varieties of onion, and 100 metres between green and white seeded varieties of broad bean.

A wide range of crops, including beets, Swiss chard, spinach, brassicas, carrots, radish, onion, broad bean and runner bean seed crops, are included in the zoning schemes. In the important seed-growing area of Noord-Holland over a hundred zones have been mapped. The zoning schemes do not exclude the growing of crops in an area zoned to another seed crop, provided the isolation meets the requirements, but in cases of dispute, crops growing in the correct zone are given priority. When the zoning prerogative does not settle a dispute, it is the first of the two crops to be contracted that is considered to have priority. Regulations have also been laid down to decide the priority of crops growing on the borders between two zones.

The Official Seed Testing Station, directed by Dr. W. J. Franck, is at Wageningen. One of its most important services to the vegetable seed production industry is the analysis of samples from seed growers. These samples are tested for moisture content and cleaned in small cleaning machines to assess the percentage cleanings they contain. Cleaned seed is then subjected to tests for germination and purity. The price paid to the grower by the contracting seed firm is based on the analysis for moisture content, cleanings, purity and germination.

For the sale of seed for sowing, the result of the seed analysis is computed as the *Gebruikswaarde* (usage value)* which is determined as follows:

$$\frac{\% \text{ Germination} \times \% \text{ Purity}}{100} - 3 \times \% \text{ Injurious Weeds}$$

Every year the Official Seed Testing Station prescribes minimum figures for the *Gebruikswaarde*, and for some seeds minimum figures for germination percentage below which seed may not be offered for sale. These minima are largely determined by the supply of seed available at the time, and the general condition of seed during the harvest year in question.

Breeding of New Varieties Nearly all vegetable varieties grown in Holland have been bred and introduced by seed firms, and at present the degree of competition for the breeding of improved varieties is high. One comparatively small seed firm visited in Holland has some twenty-five plots of land, mostly less than 2 acres in size, for the purpose of obtaining sufficient isolation for breeding and stock seed production. An incentive to the breeding of improved varieties has been the Plant Breeders' Decree of 1941. This enables a breeder to register a new variety, provided it has some distinctive characteristic by which it may be readily recognized, and claim the sole legal rights for its multiplication, either by himself or by persons nominated by him.

The work of the I.V.T. is concentrated mainly on the more fundamental aspects of the breeding of vegetables, soft fruit and tobacco, and the classification and identification of varieties. The policy of the I.V.T. in respect of plant breeding, has been to carry out investigations to find new and better methods of breeding, and to make raw material available for further improvement by private breeders and seed firms. The adoption of such a policy has been influenced by the high standard of breeding work carried out by private firms, and the control of strain quality exercised by the

*This should not be confused with "real value," a term sometimes used in Britain for the figure obtained by multiplying percentage germination by percentage purity, divided by 100, not taking into account the percentage of injurious weed seeds.

N.A.K.-G. As a result of these two factors, the prime qualities of the raw breeding material are put to the fullest possible use in raising and maintaining the quality of strains available to the market-garden industry as a whole.

As an example of the objective breeding work of the I.V.T., the production of French beans resistant to the Bean Mosaic virus 1 may be cited. Bean Mosaic causes considerable losses in Holland, and it appears that the strinless varieties preferred there are particularly susceptible to this disease. Resistant strains have been obtained by crossing Dutch varieties with a strain of the American variety, Refugee. A very interesting line of work is being carried out at the I.V.T., in conjunction with Professor S. J. Wellensiek of the Horticultural Laboratory at Wageningen University, on the role of vegetative reproduction of cross-pollinating vegetables in the breeding of new varieties.

It will be evident to the reader that there is a high degree of organization of the Dutch vegetable seed-producing industry. The broad aims of this organization may be said to be the encouragement of breeders, the prevention of the multiplication of seed of inferior strains, and the indication to Dutch growers of the varieties most suitable for their requirements.

The writer wishes to acknowledge the cordial co-operation of seed growers, seed firms and research stations in Holland, and in particular that of Dr. O. Banga, Director of the I.V.T., who helped to plan the tour. The visit was made possible through the award of a Travelling Scholarship by the Ministry of Agriculture and Fisheries.

APIMYASIS

P. S. Milne, B.Sc.

National Agricultural Advisory Service, Rothamsted

BEES imported into this country are subject to an import licence issued by the Board of Trade, and must be accompanied by a certificate of health from the appropriate government department of the country of origin. Selected consignments of bees are examined as soon as possible after their arrival here. In the case of imported colonies of bees the combs are inspected for brood disease and a sample of the adult bees is sent to the N.A.A.S. laboratory at Rothamsted for examination for adult bee disease. Consignments of queens from abroad are checked by removing worker bees from the travelling cages, these workers then being sent to the laboratory for examination as a composite sample representative of the consignment as a whole.

During 1950 check samples of worker bees were taken from fifty consignments of queens arriving from Italy. Three of these composite samples, each from a different Italian breeder, were found to include bees parasitized by larvae of a dipterous fly. This condition, hitherto unrecorded in this country, is known as *Apimyasis*. (A *myasis* is the infestation of any part of the body of a living animal by dipterous fly larvae ; the word is derived from the Greek *muia*, a fly.) Altogether seventeen bees were found to be affected in this way. A single fly larva was present in fourteen of these bees, while the other three each contained two larvae. All the larvae were found in the thorax, apparently feeding on the muscles and other tissues lying within the chitinous envelope. All the affected bees were dead on arrival at the laboratory, but presumably they were alive when they were placed in

the queen cages for dispatch from Italy. The three samples in which the larvae were discovered were examined on July 11, July 18, and October 12, respectively.

The first report of a myasis in the honey bee came from South Africa (Villeneuve, 1916). He described a new species of fly, *Rondaniooestrus apivorus*, (Diptera, Tachinidae), whose larval stage was found in the abdomen of the worker honey bee. Further observations on the habits of this fly were made by Skaife (1921, 1939), also in South Africa. The fly is larviparous ; the eggs hatch within the female reproductive system and are deposited as tiny maggots. According to Skaife, the fly hovers in front of the hive and swoops down at intervals, depositing a newly-hatched larva on the body of an ingoing bee at each swoop. The larva burrows into the abdomen of the bee through one of the intersegmental membranes. As it grows it comes, in about four weeks, to occupy the whole of the interior of the abdomen, feeding as an internal parasite. The bee dies, the fully grown larva leaves the dead body of its host and pupates in the ground. The fly emerges from the puparium in about ten days.

Senotainia Other fly larvae, found as internal parasites of the thorax of the honey bee, have also been described. Of these the life history of another Tachinid, *Senotainia tricuspis* Meig., is perhaps the best known.

The most complete account of this parasite is given by Simintzis (1949). The fly resembles the housefly in general build and appearance. It is 5 to 7 mm. in length, with a yellowish-white band on the head, between the eyes. On a sunny day in July or August the female can be seen sitting on the roof of a hive, on the front near the entrance or towards one side of the alighting board. Suddenly, it flies off after a bee leaving the hive, pounces on it in full flight and then returns to lie in wait for another victim.

Senotainia tricuspis is larviparous. Simintzis records that bees which he captured immediately after they had been attacked by the fly contained a minute larva in the anterior part of the thorax, just behind the head. It seems, therefore, that the fly inserts the newly hatched larva directly into the thorax through the articular membrane of the cervicum or "neck" of the bee. At first the parasite lives in equilibrium with its host, lying between the thoracic muscles and nourishing itself on the body fluids. Later, when the bee dies, the larva completes its development by feeding on the dead muscular tissue. When it is fully grown it completely fills the chitinous shell of the thorax. It then leaves the bee, usually by a hole made through the cervical membrane, seeks shelter in the ground, and pupates. The pupal stage lasts ten to eleven months, the first flies emerging in June of the following year. The observations of Simintzis on the habits of the fly have been confirmed by Jacquinot (1950).

This form of Apimyasis has been recorded from the Ukraine, from the Midi and the Rhône valley in France, from Sardinia and Algeria. It is known also in Italy, according to information supplied by the Italian authorities responsible for the issue of health certificates for bees and queens exported to Britain. Two puparia were obtained from the larvae discovered in the check samples which were examined here : one of these has died, but it is hoped that the survivor will in due course produce a fly which can be submitted for identification. The larvae were found on removing the head and first pair of legs during the usual routine process of examining the bees for acarine disease. The fully grown larva is 8 to 9 mm. long and is readily seen without the aid of a lens.

Whether the adult Senotainia can survive and breed in our climate is an open question. It is possible that larvae were imported in pre-war days

when Italian queens and their attendant workers came in freely without any form of control and that the absence of any previous reports of Apimyasis here is due to the failure of the fly to establish itself. Nevertheless, the possibility that it can breed here must be reckoned with. Beekeepers who regularly dissect bees for acarine disease are therefore asked to send any larvae which they may find in the thorax of bees in samples submitted to them for examination, to the N.A.A.S. at Rothamsted Lodge, Hatching Green, Harpenden, Herts. The larvae, with a few decapitated bees, should be enclosed in a small tin box. It is during the summer, from June or July onwards, that they may be found. They should not, be confused with the larvae of " hump-backed flies " (Diptera, Phoridae) which are often found feeding on *dead* bees in the combs of a colony which has died out, or on the floorboard of the hive.

References

Quelques observations sur l'Apimyase. JACQUINOT, R. *Rev. franc. Apic.*, 1950 **11**, 434.

Larves de diptère du genre Sénotainia, parasites thoraciques internes de l'abeille adulte. SIMINTZIS, G. *Rev. franc. Apic.*, 1949, **11**, (*Etudes scientifiques originales Dec.* 1949, 13).

A Tachinid parasite of the honey bee. SKAIFE, S. H. *S.Afric. J. Sci.*, 1921, **28**, No. 2.

Insect pests of the hive. 1, The Tachinid parasite. SKAIFE, S. H., *Bee World*, 1939, **11**, 106.

A new species of Tachino-Oestrid from South Africa. VILLENEUVE, J. *Dept. Ann. S. African Museum*, 1916, **15**, No. 6.

PURE STRAINS OF GRASS SEED

An Eighteenth Century Scheme

G. E. FUSSELL, F.R.Hist.S.

TWENTY years after the Society for the Encouragement of Arts and Manufactures considered that through their efforts pure strains of pasture grasses had been produced on a commercial scale, William Curtis was lamenting that the only two sorts of grass seed that could be purchased in London were ryegrass (*Lolium perenne*) and meadow soft grass (*Holcus lanatus*), the latter sometimes sold under the name of Yorkshire Grass. Possibly these two kinds were on sale only because there was a demand for them. Curtis could not quite understand this demand. He could not understand why ryegrass was the only true grass that was sown with red clover in seeds mixtures under the barley crop of the four-course rotation. He argued that it was extremely improbable that of upwards of one hundred grasses growing wild in this country, only this one was suitable to be cultivated for pasture or as a forage crop. He thought that many other grasses were superior to it and a good deal of existing meadow might be improved by the introduction of some of our best grasses—an opinion which had long prevailed amongst some of the foremost agriculturists and had persuaded the Society of Arts to offer premiums in the 1760s. The Society, when it dropped its premiums, considered the object achieved ; Curtis did not, and set out to do the work all over again in a commercial way.

Before the Society of Arts offered its premiums, the common way of getting seed when intended for the improvement of grassland was to gather up the hayloft sweepings, including, of course, a fine crop of weed seeds ! The Society of Arts decided that something must be done about this—if no more than to arrange for a supply of clean seed that would abolish sowing weed seed to the detriment of more nutritious grasses. The desideratum of the day was, of course, to increase the supply of winter fodder for cattle.

In 1763 the Society offered a premium of £20 to the person who should "grow and produce to the Society the greatest quantity of the cleanest hay seeds, not less than ten sacks, threshed from hay that has stood till ripe." No one came forward to claim this premium, and the Society came to the conclusion that the only way to get pure seed was to have it collected by hand. They therefore planned a succession of premiums designed to carry a scheme of collection, growing on and commercial production through its various stages.

The following year the Society declared that there were eight or ten species of English grasses which were greatly preferable to all others. They did not commit themselves so far as to name them, because the species varied with different places, but, subject to the right to exclude those not really valuable or useful, offered £5 for the largest quantity—not less than 10 lb. —of each species gathered by hand and kept separate. The proviso was added that the seed collected must be that of one of the true English grasses, and not one of the legumes like clover, sainfoin or lucerne which were really of foreign origin.

Claims for the premiums were made for several kinds of grasses, and in the high-flown language of the day, attention was excited to this promising means of the improvement of pasture. Some of the grasses that the Society had in mind were rare, so in 1765 it offered £5 for a quantity of not less than 1 lb. These were specified as the vernal, fine bent, meadow foxtail, sheeps' fescue, crested dogstail and common poa. Competitors who wished to identify the species more certainly were invited to inspect specimens of the grasses at the Society's offices, and were referred to Benjamin Stillingfleet's *Miscellaneous Tracts relating to Natural History* (1759) and John Mills' *Practical Treatise on Husbandry* (1762). In 1766 a gold medal was also offered to noblemen (who would not have been attracted by a small money prize), for collecting not less than 2 lb. of meadow fescue, yellow oat and annual poa, and for sowing in drills the greatest quantity of land (not less than 1 acre) with any of the kinds in 1767.

Difficulty of Identification The advice to consult Stillingfleet and Mills was not received without criticism. Thomas Comber, Jun. of East Newton, Yorkshire, had, in June, 1764, recently applied himself to the perusal of Mr. Mills' account of the grasses for the seeds of which the premiums had been offered, but though he admitted that Mills had given "all the light on the subject that he could derive from Stillingfleet's *Essays* and the delineations of the several grasses which that ingenious inquirer had formed," Comber found the instruction insufficient. He found it difficult to identify the grasses from the drawings, which were in black and white, and could naturally show the grasses only in one stage of their growth. He had collected some grasses but was doubtful about their identification, as also were some people to whom he had shown both the specimens and the drawings ; so he sent his complaints and his specimens to the editors of *Museum Rusticum*, an ephemeral agricultural periodical of that day. The complaints were printed, and the grasses fully and explicitly identified in editorial footnotes expressed with some asperity.

Because of its general agricultural interest, and the fact that the papers published were edited by members of the Society of Arts, this periodical devoted a great deal of space to the grass seed scheme. Possibly as a result of Comber's complaints, an enthusiast who called himself "Londonensis" spent some time collecting specimens of the grasses for which the Society of Arts had offered premiums, and the editors had a plate engraved. They did the same thing from some specimens collected by "Clericus" of grasses not

illustrated by Stillingfleet. This contributor thought that the premiums were not enough to raise the ardour of gentlemen ; the only way to achieve success, in his opinion, was to increase the premiums so that gentlemen would compete by getting 1 oz. of each species, sowing it in drills kept absolutely clean, harvesting the resultant seed and growing it on, so finally securing a commercial supply of pure strain. He was another critic of Stillingfleet's plates, which do not include yellow oat or common poa, both of which had then recently been delineated in *Museum Rusticum*. Nevertheless, he thought Hudson's admirable *Flora Anglica* the best book of reference—a work which cannot be read too much by every person who would know the natural history of England. It supplied the title of each indigenous plant according to the Linnaean system, its synonyms, local names, habitat, and flowering time. It was, perhaps, a result of Clericus' lucubrations that the Society of Arts offered a gold medal for the competition of noblemen.

The Society's premiums were not considered too small by Philo-Gramen of Clapham, Surrey, who admitted that knowledge of grasses was still in its infancy, and who would neither praise nor condemn ryegrass. Through the interest aroused by the Society's premiums, it was not unreasonable to expect to discover which of the grasses was " best for yielding the greatest bulk of good hay, will bear the most frequent repetition of the scythe, is suitable for light or heavy soils and is best for fattening each kind of livestock". In a field of ryegrass, crested dogstail and cocksfoot, for example, he had found that horses and cows would leave the dogstail and sheep the cocksfoot.

There was, nevertheless, some danger that the desire to win the Society's premiums might lead people astray. The Society was persuaded by Bartholomew Rocque that burnet might prove a winter food for cattle, and accordingly offered premiums for its cultivation, one of which was won by the Rev. Lambe. Claims were made for many parcels of land some not less than 30–40 acres, by gentlemen who gave very favourable accounts of the plant. There was a division of opinion about its value, but in 1768 its cultivation was reported to be extending, especially in some parts of Lincolnshire and Suffolk. All that Philo-Gramen would admit was that it promised to be a very useful pasture, but as yet very little was known about it. " Poor old Rocque," he adds, "though he assures you 'dat his horse do eat de bornet straw' candidly owns that he prefers lucerne if offered the choice."

In 1766 the Society of Arts changed its premiums again. It offered £10 for the greatest quantity of seed of each of the grasses named in 1765 gathered clean from the fields by hand, or produced and clean saved from such seeds gathered in 1765, sown in drills and kept clean and free from all other grasses or weeds. This was followed in 1767 by an offer of £20 for the greatest quantity of land, not less than 1 acre, sown in drills with each of the selected grasses, each kind to be unmixed with any other kind. After that year the premiums were discontinued, except for vernal grass which was not claimed. The Society considered that by its carefully thought-out scheme of premiums it had encouraged first the collection of clean seed of the different varieties, then its cultivation and careful harvesting, and finally the last premium had been, in effect, for the production of commercial quantities of clean seed that could be sown separately or in judiciously chosen mixtures. The consequences of this pursuit must necessarily, thought Philo-Gramen, be attended with very considerable improvement in pasturage.

Interest in Pure Seed Stimulated Whether it really did achieve the commercial production of pure strains is doubtful, but a method of procuring supplies of clean grass seed had been developed, and people like Coke of Norfolk used that method for securing

their own. Coke is said to have taught his tenant's children to collect the seeds, and indeed there was no difficulty about that. Philo-Gramen relates that children of ten and eleven had done the work without mistakes, and it is easy to imagine that their interest could readily be aroused. In 1761 a little boy gathered ¼ lb. of crested dogstail seed from a patch of grass by the side of a road, and a certain Mr. Aldworth of Stanlake got a full bushel from a grass plot where it flourished. Comber suggested that a meadow of hay might be badly damaged by seed gatherers, so a path should be cut when the grasses were ripe and the seeds collected from the swath.

As I have said Curtis did not agree with the Society's view that the work was completed by 1767 and both he and the Rev. G. Swayne (*Gramina Pascua*, 1790) were doubtful whether the average farmer could distinguish between the many very similar grasses that had been given different names, so that even the botanists were hard put to it to sort them. Swayne thought that more species had been named than really existed, although of late years they had to some extent been reduced by botanists. Indeed, there was a good deal of controversy about the species amongst the recognized botanists, and as William Curtis wrote in *Practical Observations on the British Grasses* (1790), this difficulty of distinguishing the grasses from each other had proved a grand obstacle to the projects for improved and clean seed. " Where the most discerning botanist was often at a loss, how easily may the husbandman be deterred from the task ? " he reasonably observes. Moreover, grasses as well as other plants had frequently been recommended from a partial and limited observation of them by persons who had recommended them merely to gain the credulity of the public.

Swayne could not and would not express an opinion about the value of the different species. He believed in experimental tests. A large quantity of separate seeds must be collected, sown and tried for a considerable time in feeding various classes of livestock, and then, when the value as crop and feed of each had been established, judicious mixtures could be formed so that the most productive sward was obtained. His book was a novel attempt to render the pastures well known, and instead of drawings he mounted specimens of the actual grasses on blank leaves opposite their descriptions.

Curtis, who was satisfied that no pure strains of clean seed were yet on sale, notwithstanding the efforts of the Society of Arts in providing premiums, thought he ought to do something about it. Accordingly he wrote his pamphlet illustrated with coloured plates, and recommended six of the natural grasses that constituted the bulk of our best pastures. To this theoretical effort he added the practical one of offering for sale " The packet of grass seeds recommended in this pamphlet " for ten shillings and sixpence as well as instructions what to do with them. Each species should be carefully sown, he said, and the seed as carefully harvested, and then, when the land intended to be seeded down had been cleaned by repeated ploughing and by burning the couch and other weeds or by paring and burning the turf, a mixture should be sown consisting of :

1 pint each of meadow foxtail and meadow fescue;
½ pint each of smooth and rough stalked meadow grass;
½ pint each of sweet scented vernal and crested dogstail;
½ pint each of dutch clover and wild red clover or in place of the latter, the broad clover of the shops.

For wet lands the crested dogstail and smooth stalked meadow could be omitted, especially the former.

This was the extent of the eighteenth century attempts to produce clean and type-true strains of pasture grasses on a commercial scale, and they seem to have had no very satisfactory outcome.

FARMING AFFAIRS

Lucerne Lucerne is a popular topic in farming circles at the present time. For more than a quarter of a century I have never been without a field or two of this very useful forage crop. It may, therefore, be of some interest to relate my experiences. My land overlies chalk at depths varying from a few inches to several feet. All is free-draining in a district with an average annual rainfall of around 20 inches, mostly in winter. In the beginning there were two fields which had been let go to grass after bearing lucerne for a number of years. In both there was still a fair sprinkling of sturdy lucerne plants. One field I slagged and afterwards grazed. The lucerne quickly disappeared but a very productive pasture developed, from which I secured several crops of wild white clover seed. The other, for lack of water and fencing, was left for mowing. It has now been ploughed up but for twenty-five years the lucerne persisted, neither gaining nor losing ground among tall oat grass, tall fescue and a surprising amount of red clover and alsike where the village youngsters played football in winter.

There is no difficulty in establishing lucerne on this ground without inoculation, and it has never failed when drilled under a cereal in spring. Besides seedings of pure lucerne, I have sown mixtures of lucerne and sainfoin, and lucerne and cocksfoot and have included up to 4 lb. of lucerne per acre in temporary and permanent grass mixtures. In grass mixtures under free range grazing, lucerne disappears almost entirely in a year or two, although an occasional weak plant may be found even after many years. When, however, such grass mixtures are grazed only in autumn and winter, after a hay crop, lucerne will continue to flourish, it seems, indefinitely, if fortified by occasional dressings of dung and phosphate. To my surprise I have discovered that another way of strengthening lucerne was to let the first aftermath of the season stand for seed. The increased density was not due to fallen seed, for the crop contained so little seed that it was never threshed.

On this soil lucerne will give a full cover for five to seven years. When it is ploughed up many of the roots are so thick as to jar the tractor, and usually about a half stand of lucerne reappears in the first corn crop, so giving useful stubble grazing. I have never thought it necessary to hoe or harrow lucerne for the purpose of checking weeds ; a dense crop cover will take care of weeds. In some circumstances, however, as when lucerne is sown alone, cultivation may indeed be an advantage, for lucerne will sometimes spring up thickly in a gateway where every green thing has been puddled out by stock entering and leaving.

Lucerne smothers sainfoin but thrives well along with a few pounds of cocksfoot. I have, so far, stuck to cocksfoot as the companion grass because it withstands the severest drought and will, I think, provide more winter grazing than either timothy or meadow fescue. It is not, however, an ideal companion since it is ready for cutting before lucerne reaches the flowering stage—a drawback which, however, applies only to the first cut. Timothy is prominent enough in the local lanes and a diminutive form of it occurs indigenously in chalkland pasture. I mean to try it.

I usually take the first cut for hay, waiting till some flowers are beginning to show. I am convinced that lucerne persists longest when neither cut nor grazed till the flowers appear, by which time new growth is usually beginning to sprout at the base. Such delay, however, is not always practicable. Lucerne may be needed for soiling or even grazing, especially when pastures are burnt up. But at least once in the course of the season

it is desirable to let it run up to flower. In this condition I have turned on cattle of all ages, also horses, and never had a case of "blowing". They have, of course, been introduced to it gradually.

From time to time both first and second cuts have been made into clamp silage but, on the whole, my animals seem to prefer it as green hay, which is also handier for outwintering stock. And in this upland breezy country it was possible, even in 1950, to save lucerne in good condition without appreciable loss of leaf and with most of its green colour intact. It is only when exposed to hot sun that leaf becomes brittle and drops off. Protected from blazing sun and cured by wind, the leaf remains pliant and the colour also is retained. It usually means early cocking of some kind combined with stacking on a twelve foot base. One length of stack is completed in a day or an afternoon and a further length is added with a vent between. Salt is sprinkled over each layer as stacking proceeds.

Autumn growth is commonly allowed to die down for the winter. No harm, however, results from turning on stock to graze as soon as lucerne ceases to grow, usually about November. By that time it has stored in its roots practically all the food reserves it can store, and removal of the final growth will not, therefore, affect the supply. Animals will browse gradually from the top downwards and leave sufficient stubble for protection.

It is always desirable to sow on clean land in good heart with a plentiful reserve of dung and phosphate. If dung cannot be spared outwintering animals should be "fed on" with kale, mangold, hay or silage and the droppings chain-harrowed. This year it was possible to get three good cuts but, as a rule, two cuts, followed by late autumn and winter grazing, would represent the general output.

With the exception of dung, no manure seems to give much response once the plant is firmly established. On chalkland, charlock is apt to be troublesome in the initial stage. For some years I have obtained practically a complete crop with calcium cyanamide without harm ; indeed I think with benefit to the lucerne seedlings. Atle spring wheat makes a very satisfactory nurse or cover crop.

J. G. Stewart

Farming Cameo: 5. Chichester, West Sussex

The Chichester District forms the south-western quarter of the administrative county of West Sussex, with the City of Chichester and its market in the centre. Its boundaries lie eastward on the River Arun and westward on the Hampshire border. Northwards it extends throughout the South Downs almost to the brink of their steep northern escarpment, and southwards to the sea. The annual rainfall varies from 22 inches on the coast to 36 inches in parts of the Downs.

There are three main soil types, running in parallel strips east and west. The most northerly, accounting for about one-third of the district, is the chalk, giving rise not to the thin, bare downland as of Wiltshire or East Sussex but to naturally wooded slopes and a greater depth of soil. Towards the Hampshire border are considerable areas of clay-with-flints pocketed in the chalk, giving rise to stiffer soil, tricky to work but capable of yielding good wheat crops. These clay pockets are usually acid, and locally obtained ground chalk is generally used, both here and throughout the district. Downland farm units are generally large, up to 2,000 acres, and are well mechanized. The crawler tractor and combine drill have both been important contributors to present prosperity. The farming system of forty years ago, centred on the hurdled flock of Southdown sheep, with its attendant rotation strictly adhered to, has been superseded by the dairy herd in conjunction with a ley

farming policy. Barley is still the principal corn crop, but satisfactory crops of wheat, potatoes and sugar beet are grown. Atle wheat has no serious rival on these farms at present ; it is generally autumn sown and yields up to 12 sacks per acre under favourable circumstances. Short-term grazing leys are much in evidence, rendered possible by extensions of water supplies, and herbage seed production and grass drying are on the increase. Much scrub clearance and reclamation has been carried out during and since the war.

At the southern foot of the Downs the chalk gives way to valley gravel, a narrow zone about 2 miles across, save for incursions up the dry downland valleys. So substantial are the deposits that gravel-digging has been carried on in a big way for many years to the south-east of Chichester, and the loss of valuable farm acres to this vital industry continues. Farming on the gravel does not differ greatly from that on the chalk, except that holdings are generally smaller and less remote. In most cases the system pivots around the dairy herd. The gravel is a hungry soil, but responsive to humus and fertilizers. Exceptionally free-draining, it can suffer in dry summers but has the compensation that stock can be outwintered, and the land is seldom unsuitable for working. Lucerne and cocksfoot are invaluable and used extensively, and sugar beet makes an important contribution to the farming system—as it does throughout the district.

Southward of the gravel to the coast stretches the Chichester Plain proper. This deep, free-working Brick Earth is fairly uniform, but in places is at sea level and drainage is dependent upon the upkeep of "rifes" and outfalls. There are some patches of London Clay on the coast, but generally it is an area where yields of wheat and sugar beet can stand comparison with the best of East Anglia, and farmers are concerned to choose cereal varieties which stand well. Many of the larger farms have never known a dairy herd, bullocks being yarded in winter and finished in summer on the "brookland," which is a feature of the lowest-lying areas. The North Devon is the beef animal of the district, and a regular supply of West Country stores finds its way to Chichester Market. The grazing ley is on the increase, and the folded flock, formerly such a feature of the area, is now hard to find.

West of the city a considerable area of the Brick Earth is devoted to intensive market gardening, produce going to the Portsmouth and Southampton markets.

In an area so popular for holiday-making, there is an ever-present tendency for attractive farm dwellings to be acquired as residences and thus lost to the land they were designed to serve, while there is a real danger of caravanning sites, without due control, becoming regarded as the most profitable "crop" for the land.

N. I. Gilder, *District Advisory Officer.*

Farm Repairs of Machinery Farmers who have fitted up farm workshops and have found how useful they are, soon begin to ask themselves whether they ought to be doing the major repairs of implements as well as the maintenance and running repairs and off-season overhauls for which they first fitted up the shop. The decision is difficult and important.

It is almost certain that when a big job has to be done to an implement or tractor, the implement agent can do it quicker and better than the farmer. It is likely, too, that if the farmer takes into account the value of the time he and his men would spend on the job, and the special tools he would have to buy for it, he will find it cheaper to let the agent repair the machinery.

There are, however, two circumstances that cause many farmers to go deeper into repair work. One is that the value of the time of farm workers is not the same all the year round. At rush seasons, such as harvest times, a farmer would be risking his whole livelihood if he spent his time and that of his men on overhauling machinery. But there are times when the weather stops other work and gives hours which, spent on the overhaul of implements in a warm, well-lit workshop, would be absolute gain. The second of the two circumstances is the simple fact that many farmers enjoy going over their machines themselves. If this can be done without neglecting any other part of the farm work, so well and good. The man who does his own overhauls, and therefore knows the inside construction of the machines, is more likely to use them sympathetically, and so get longer service from them and fewer breakdowns in the field.

All the same, major repairs and overhauls are not things to be undertaken too lightheartedly, particularly when the season calling for the use of the machines is not far away. Unless a considerable stock of spare parts is kept on the farm, the amateur repairer will have to make several journeys to the agents to get one part or the other as he decides that the old part has worn too badly to serve again, or to replace parts broken in the course of the repairs. And the agent cannot be expected to hand over parts at short notice at a time when he may want them for repair work he is doing for other customers. It must be remembered, too, that the volume of repair work done by an agent on any one make of implement makes it worth while for him to buy special tools which, though they are not essential, do shorten enormously the time taken on the job. This is particularly true of tractor repairs. Tractors are made by quantity production, and the design of their details is often a compromise between what is wanted to make the tractor easy and accessible to repair, and what is wanted to make the production line of manufacture flow smoothly. The agent meets this by buying tools designed specially to deal with the detaching and reassembly of awkward parts.

In fact the art of looking after machinery lies in knowing how far to go. The cobbler may profitably spend a bit of time tidying up his shop and sharpening his tools, particularly at a time when there are no shoes to mend, but in the main he is wise to spend most of his working hours sticking to his last.

H. J. Hine

Mechanical Hedge Trimmers While there are some people who consider that live hedges are impracticable nowadays, there are others who feel that there is a good case for this type of fence. One thing, however, is clear, and that is if hedges are not kept under control they are best not kept at all. Bad hedges may mean bad neighbours, for every man must fence against his own stock. The deplorable condition of many hedges today is mainly due to lack of annual brushing, which, in turn, is generally due to shortage of labour. It is here that machine trimmers can help, although it should be stressed that a machine cannot *make* a hedge. To get full value out of a machine, a hedge must be in good condition ; if it is not so, it should be brought into such condition by laying before the machine is used.

The machines available may be divided into two main types : the Cutter-bar, and the Rotary.

THE CUTTER-BAR type works on the same principle as the farm grass mower, with reciprocating cutter-bar. Various models are available :

1. *Tractor*. These have a cutter-bar approximately five feet wide, which

is driven by a 1½–2 h.p. engine. The engine and cutter-bar are mounted either on the tractor, the maker's own carriage which is trailed or pushed, or a farm trailer.

2. *Self-propelled.* On this type the engine and cutter-bar are mounted on a self-propelled carriage which is guided by a man walking.

3. *Hand.* A shorter cutter-bar of about 18 inches is driven either by compressed air or an electric motor mounted on the handle. Current is derived either from the mains or from a portable generator, but clearly the occasions when mains can be used on a farm must be very limited. For this source to be practicable, the hedge must be short in length and close to a supply point.

In general, the cutter-bar type is designed to deal with the annual brushing of a hedge, although some models will cut stems up to two inches thick. If the cutting sections are kept sharp, the larger machines do a good job more quickly than a man, and it would seem that here lies the answer to the problem of this unproductive task.

ROTARY TYPE. The rotary type is a much more drastic tool, capable of cutting through growth on hedges which have been neglected for many years. Machines of this type are mounted either on a special trailer or directly on to a tractor, but in each case power is obtained from the tractor engine. More than one kind of cutting head is in use. Some have a saw-toothed blade, similar to a circular saw, which, it is claimed, will fell trees up to 14 inches in diameter. Others have hooked or scimitar shaped blades mounted on the periphery of a revolving plate of about 4 feet diameter.

The proper treatment for an old neglected hedge with thick growth is, of course, laying, if it is to remain stock-proof ; a hedge trimmed by a rotary machine is usually far less stock-proof after treatment and much of the wood needed for laying has gone. Possibly this machine could be used to save the hedger time in preliminary side-trimming, but unless the greatest care is taken by the operator not to cut too deeply into the hedge, it is doubtful whether a skilled craftsman would take on the job of trying to lay it, for selection of the most suitable growths is the key to good hedge-making.

Where, however, a hedge is to be kept purely for shelter and fenced, the rotary machine can be very useful. Such a hedge will not receive annual attention, but it must be kept within bounds by periodical trimming, and this job can be done quickly and efficiently by the rotary machine. This type of trimmer is probably more suited to the contractor than to the farmer or estate owner.

G. B. Youard

Malltraeth Marsh : Report of the Welsh Agricultural Land Sub-Commission

Many years ago the area known as Malltraeth Marsh, on the eastern side of the Isle of Anglesey, was under several feet of water ; it was, in fact, the wide estuary of the River Cefni. Subsequent silting of the estuary reduced the width of the river until, by the middle of the eighteenth century, an area of marshland had been left on each side which was flooded in turn by the river and the sea.

In 1788 Parliament decided that this land might be more profitably used for agriculture, and an Act was passed providing for an embankment at the seaward end of the marsh, and "for making Cuts and Channels and other works, for draining and preserving same". Since 1788, reclamation work has proceeded, and three further Acts were passed during the next seventy-five years, amending and extending the first Act. The work had a setback

in 1796, however, when, on January 23, a flood-tide caused a great deal of damage, and work was abandoned for a time.

Under the latest Act, passed in 1859, work has been going forward steadily, mainly on repairs and improvements to the original drainage scheme laid down early in the nineteenth century by Telford (the civil engineer who was, incidentally, responsible for the construction of the London-Holyhead road). As recently as 1946, nearly £150,000 was spent on cleaning out the entire drainage system.

The greater part of the Marsh is at present under grass of varying quality, and is devoted to stock rearing. There is some tillage, but mainly for the maintenance of livestock. At the request of the Minister of Agriculture, the use of the whole of this area has recently been investigated by the Welsh Agricultural Land Sub-Commission. The recommendations made in their Report* include improved drainage of the Marsh, and efficient maintenance of the system ; readjustment in the layout and size of holdings on a more economic basis, and the provision of adequate farm buildings, piped water supplies and farm roads. A map is enclosed with the Report, showing the area of the Marsh, the existing drainage pattern, roads, and water mains, and indicating possible improvements.

BOOK REVIEWS

Farming for Beef. ALLAN FRASER. Crosby Lockwood. 10s. 6d.

Some people are spellbound by anything that savours of "science". Just because it is new or has some official or expert backing it must, they believe, be better than the old or traditional. Allan Fraser, however, is a distinguished scientist who has learned from practical experience that to doubt is sometimes safer than to be sure.

And differing judgments serve but to declare,
That Truth lies somewhere, if we knew but where.

Dr. Fraser in common with most other folk, would like to see a far greater output of British beef. In this book he examines the problem, and many of the accepted ideas about it, with Shavian scepticism, irreverence and perspicacity. If the productive resources of British soils and climates are to be fully exploited, agriculture must be treated as an entity with its different forms far more closely knit together than at present. Compared with pre-war days, we already have more cattle which are, however, producing less beef. Of several factors bearing on this paradox, the chief is the special encouragement given to dairying, with consequential change from beef and dual-purpose cattle to the dairy breeds producing milk for the liquid milk market. The question of dairying and its influence on the supply and quality of home-killed beef is discussed at length. And since, at the present time, one-quarter of all our home-killed beef is cow beef, it is surely of some importance, according to the author, that the cows from which that beef comes should have some inherited capacity for producing beef. Dr. Fraser puts the average milk yield of recorded dual-purpose cattle at 700 gallons, and the average yield for the country, including dairy as well as dual-purpose cattle, at rather less than 600 gallons. From this he argues that the intensity of management and feeding commonly practised at the present time is unable to support the genetic potentiality for milk yield in a dual-purpose cow, let alone a record-breaking Friesian. "We have sacrificed the substance of meat for the shadow of milk."

Further possible sources of increased beef production are our hill and marginal lands. The hill can produce calves to weaning age, and marginal land can carry them on a stage further for satisfactory and successful feeding on the lowlands. But neither can produce

* *Malltraeth Marsh Investigation*, price 1s. 9d. (1s. 10d. by post) from H.M. Stationery Office or through any bookseller.

finished beef. That must continue to be a product of lowland farms. The profitability of store raising must therefore depend on the profitability of beef. Dr. Fraser knows hill farming to be a tough proposition and has no patience with "sentimental nonsense".

In present circumstances any appreciable increase in beef production is probable only off grass. Winter fattening is seldom directly profitable and its continuance will depend mainly on the value attachable to dung. If and when beef becomes as profitable as dairying or is saleable at a price comparable with that of other meat, there will be no lack of it, "because, besides being an easier job, beef production, particularly beef from dual-purpose cattle, is the preference and tradition of wide districts in this country". However, the cheapest method of feeding a herbivorious animal must always be to put it where its food grows and let it do its own harvesting there. According to the author, the idea of preserving summer grass for winter beef production has grown up within a price structure designed to ensure a regular supply of winter milk. It is a plan that will not answer for beef.

This book deserves to be carefully read and studied by all concerned with food production.

J.G.S.

Animal Nutrition and Veterinary Dietetics. R. G. LINTON. 3rd Edition by John T. Abrams. Green. 42s.

Considerably more information is contained in the latest edition of this standard work than previously. The editor is Mr. J. T. Abrams, Lecturer in Nutrition at the Royal Veterinary College, London. Of its four sections, the first deals with the general properties of the main chemical constituents of feedingstuffs and their metabolism. In the second, individual foods are discussed in detail, and many important features, such as feeding values, methods of feeding, food storage and preparation are considered. The third section, "The Fundamental Bases of Feeding Standards," is additional to those in previous issues; although occupying only one chapter, it is of first-rate importance, and, describing such items as the maintenance requirements of animals, the nutritional requirements during pregnancy and during lactation, and nutrition in relation to work, forms a definite link in the sequence of the other chapters. The last section deals with the nutrition of the different species of livestock, including, for the first time, goats.

Many new references have been added, and with these to consult it can be truly said that this text-book is up to date and full of the kind of information required by students of animal nutrition and of considerable value to those wishing to refer to any question dealing with this subject.

In this new edition the practical aspects become more and more obvious, and no one concerned with, or interested in, the feeding problems of livestock can fail to find it useful.

T.D.

British Farm Stock (Britain in Pictures Series). The Earl of Portsmouth. Collins. 5s.

It is a notable fact that British livestock, deriving its strength from its adaptability to climate and other conditions, has left its mark upon the animal husbandry of the world. Lord Portsmouth points to three outstanding influences which were fundamentally responsible for this circumstance: first, our climate, although making for hardiness, has never been so severe as to subordinate all other qualities to that of mere survival; second Britain, unlike some other parts of the world, has hardly any soil which is not capable of giving a fair sustenance to stock; and third, for many centuries the small population of England enabled good use to be made of the best land.

We claim twenty-four breeds of cattle, thirty-three of sheep, twelve of pigs and fifteen of horses and ponies, as being native to Britain, and it is over this field that the author ranges, not comprehensively, as he at once makes clear, but with sufficient representation to show how British farm stock has attained its pre-eminence, and showing at the same time the interaction of stock and men in our history.

Commercial prosperity first came to Britain on the back of the sheep, and to the great improvers—men like Bakewell, Booth, Coke, Cruikshank, and the Colling brothers, and Tuley, we owe the foundation of livestock developments which were to pay big dividends in the years to come.

Lord Portsmouth does not claim more for his book than that it is a small monograph with "an attempt to interest, as much by picture as by prose, those many who have been too much engaged in other pursuits to have had the time or cause to ponder over the history of British livestock". Nevertheless, a more attractive and stimulating introduction to the study of British farm stock would be difficult to find.

S.R.O'H.

The Dairy Farmer's Veterinary Book. NORMAN BARRON. Dairy Farmer (Books) Ltd. 15s.

Written in simple, non-technical language, this book will be of value and interest to all farmers and those who attend to dairy cattle. It deals with health and with problems of disease, explaining the causes, signs, and methods of control; it also deals with prevention and cure of practically all conditions of ill-health met with among dairy livestock. It is not a treatise on how to cope with the various diseases when they occur but rather how to prevent their occurrence. It is not intended that the book should replace the seeking of expert veterinary advice: its intention is rather to inform farmers and others of the necessity to take precautions against disease by the practice of good husbandry and to seek veterinary aid at the earliest suspicion of ill-health. It deals with both simple and complex subjects and discusses first-aid measures which can be adopted before veterinary assistance is obtained.

T.D.

Sheep Farming. (5th Edition). ALLAN FRASER. Crosby Lockwood. 12s. 6d.

In its original form *Sheep Farming* impressed everyone as well-founded common sense on a subject about which the uninitiated found it hard to get information; for those who knew couldn't write, and those who wrote didn't know. Here was someone who obviously had handled sheep, was fond of them, and who wrote in a most engaging style.

In the fifth edition of his book entire passages have been rewritten to bring it most effectively up to date. Those who have given no thought to the matter would say that there has been no material change in sheep husbandry since 1936; a glance through these pages shows this to be untrue.

Veterinary research which then offered tentative suggestions is now shown to be embodied in established practice; diseases which had long been reckoned inevitable are now responding to vaccine and serum; new dips are relieving anxiety to an extent hardly dreamed of. Grassland improvement, particularly in our uplands, has widened the flockmaster's opportunities and added to his problems. The production of mutton on grass without concentrated foods is noted as sound economy at the present time.

The author naturally has hill sheep generally in mind when making his pronouncements, and all will agree that the well-being of this important section is fundamental to the survival of our sheep stock as a whole.

Reminiscence of actual experiences adds materially to the interest of this book and the conviction it carries. Sly digs at the scientists by a scientist who is also a practical farmer give a light, whimsical touch which makes everything Allan Fraser writes so eminently readable.

W.R.S.

Soil Conditions and Plant Growth (8th Edition). Sir E. J. RUSSELL. (Revised by E. W. RUSSELL). Longmans Green. 35s.

The seventh edition of this book, which is probably the most widely known and certainly one of the most widely quoted books on soils, was published in 1937. If there have been no outstanding advances in soil science since then, considerable changes in outlook caused by advances in ancillary sciences such as mineralogy and bacteriology have necessitated a fresh interpretation of known facts.

After the war, Sir John Russell entrusted the task of bringing the book up to date to his son, Dr. E. W. Russell, who has produced a revision which will enhance still further the high reputation earned by the earlier editions. Except for the introductory historical chapter, which is reprinted almost unchanged from the seventh edition, Dr. Russell has entirely recast and rewritten the book, and the result is a brilliant presentation of applied soil science. The book is written primarily for the general soil scientist, but the practical applications of soil science are so clearly set forth that the farmer or layman, acquainted with the elements of the natural sciences, will find interest and illumination in every chapter.

Every aspect of soil science is covered adequately for both the agricultural scientist and the scientific agriculturist. A large part of the book is devoted to soil biology and its bearing on plant growth. These chapters are done exceptionally well. It is doubtful whether such a full and comprehensive survey of soil biology has been published before. Dr. Russell deserves the highest credit for the skill with which he has woven innumerable bits and pieces from a dozen different sciences into a continuous whole with a definite pattern. He cites some 1,500 references from almost every country in the world and extracts some pertinent fact from each. He is a mine of information on the most diverse aspects of his subject, and appears equally at home in discussing practical applications to temperate or tropical, arid or humid agriculture.

The value of the book is enhanced by the inclusion of numerous well-selected and instructive photographs. The index, like that of earlier editions, is unworthy of the contents of the text.

G.V.J.

BOOK REVIEWS

The Establishment of Vegetation on Industrial Waste Land (Joint Publication No. 14). R. O. Whyte and J. W. B. Sisam. Commonwealth Agricultural Bureaux. 10s.

The title of this publication describes its purpose, which is to show how far it has been possible to get vegetation established on land that has been ruined agriculturally by industry. The method of presentation adopted is to describe briefly the problem and what has been done on certain typical sites, mainly in Great Britain but to some extent also in America and elsewhere.

The first part of the book deals with the more widespread types of industrial wasteland that occur and a descriptive method for mapping them, based largely on S. H. Beaver's work in the Midlands. Then follows a description of the natural vegetation that grows on a few of these sites, and of the reasons why it is difficult to establish vegetation on most sites. Finally, methods of establishing trees and pastures on some selected sites are described, and this section contains a list of species of ornamental and timber trees that have been found useful.

The book is topical and readable but is too short (66 pages) to give any detailed discussion of the specific principles involved in several of the schemes described; hence it will be of only limited value to many of those responsible for trying to re-vegetate these eyesores. It does, however, bring together some very valuable information otherwise so scattered that it is likely to remain unknown to most workers in this field, and for this reason it should serve a very useful purpose. The sixty photographs, most of them excellent, show various types of industrial wastelands in various stages of dereliction and re-vegetation.

E.W.R.

The Land of Britain. Its Use and Misuse (2nd Edition). L. Dudley Stamp. Longmans. 45s.

It is a great achievement for the author that a new edition of this big and seemingly expensive book should have been necessary only three years after its first publication. Since that time copies of it have been taken up in all parts of the world, not only by Universities and reference libraries but also by all sorts of people who are interested in the use of land. The first edition has come through its baptism of criticism with amazingly few necessary alterations. The only major ones involve the important analyses Professor Stamp has made of the amounts of the various classes of land in Great Britain and his opinions on the potential use of our land (pages 366 and 438). On checking, he has found that Scotland has rather more good land than was first thought. His views on the potential use of Britain's land area remain practically the same.

Some readers may wish that changes in land use and in agriculture since the passing of the Agriculture and Town and Country Planning Acts in 1947 were described and evaluated. The author believes, however, that it is too early to judge the effects of these two Acts. In any case, his purpose throughout has been to record the history of the Land Utilisation Survey and to give a factual picture of how land has been used in the past and what major changes took place during the past war. It is a book that is easy to read, and one is constantly impressed by the variations that occur in the rural land of Britain. Though we have a little island where the areas of land that are suitable for alternative uses are scarce, it is rich and big in terms of differences in topography, soils, climate and settlement pattern and the ways in which these have been blended to form our landscape.

G.P.W.

Jackson's Agricultural Holdings and Tenant Right Valuation (10th Edition). W. H. Aggs. Sweet and Maxwell. £2.

It is pleasant to be able to record the reappearance of such an old friend of tenant-right valuers as *Jackson's Agricultural Holdings*, now in its tenth edition, rewritten to cover the extensive changes which have occurred in the law during the last two or three years. Although the subject is complicated, Mr. Agg's lucid pen does much to unravel its mysteries.

The book deals primarily with the law as it affects tenant-right valuations, though it covers a number of related matters. It is arranged in three sections. The first gives a general introduction to the subject and is especially valuable for the way in which it sets out the procedure to be followed by landlord and tenant wishing to claim compensation and the various matters for which compensation can be claimed. This part of the book in particular is excellently documented with references to cases which have been decided in the Courts and on which the author bases his conclusions. The position of an outgoing tenant whose tenancy commenced before March 1, 1948, might have been treated more clearly.

The second section of the book contains the full text of the Agricultural Holdings Act, 1948, and is well annotated and cross-referenced.

The third section is devoted to the actual procedure of tenant-right valuation and the principles on which valuations should be made. Some of this part of the book is out of date,

and it is to be hoped that if another edition is necessary later on as a result of further experience of the working of the Act, particular attention will be paid to the revision of this section. The costings which are quoted are generally unreliable: some of them appear to be based on pre-war prices and the acts of cultivation relate to work with horses. It is surprising in this connection that no reference is made to the annual schedule of costings prepared and issued by the C.A.A.V.

The book ends with appendices containing the text of the relevant and unrepealed sections of the Agriculture Act, 1947, a selection of the various regulations made by the Minister and a set of useful forms. The book is excellently produced and there is a full index.

Finally, one assumes that Mr. Aggs does not wish to be taken very seriously when he suggests in the introduction that as a result of the present trend in agricultural legislation tenant farmers will gradually cease to exist and instead a new relationship of owner and manager will come into being.

This is a book which all landlords and tenants of agricultural land, as well as their professional advisers, should find of great interest and value.

A.J.L.

Fruit Sizing and Grading Machinery. National Institute of Agricultural Engineering, Wrest Park, Silsoe, Beds. 2s.

When a grower chooses equipment for the grading and sizing of fruit he commits himself to the expenditure of capital, and whatever the merits or demerits of the equipment, he must accept some degree of subordination to the machine, since it will affect the operating staff, his output and packing costs and, maybe, his reputation on the market. In spite of what can be gleaned from the makers and from other growers, a machine's suitability can generally be judged only after it has been operated for some time. It must save money, time and temper if some carefully recorded experiences of operating various types of grading machines are made available, and a very warm welcome will therefore be extended to this report of fifty pages by the National Institute of Agricultural Engineering of an investigation to determine accuracy of sizing and the extent of damage during the grading and sizing of fruit. The report cannot be expected to supply all the answers because the periods over which examinations were made were short, conditions were not fully controlled, and the technique of the study had to be worked out during the tests. Nevertheless, it does give a large amount of information, not previously available, about some essential factors bearing on the choice of a grading machine for various purposes. The report represents a move in a very desirable direction, and it must be a disappointment to learn that "it is not proposed to carry out any further investigations at the moment, apart from a routine examination on the arrival of a new grader". This disappointment will be lessened, however, because a number of new graders have arrived since the investigation and these "routine examinations" are already in progress.

The present report relates to three tomato graders and five apple graders, and is illustrated with photographs and diagrams, the usefulness of which could have been improved by a little more explanation.

J.G.

Dairy Manufacturing Processes. E. L. Fouts and T. R. Freeman. Chapman and Hall. 21s.

This American handbook is intended primarily for dairy plant workers who have received no formal training, and is written very simply with an almost complete absence of scientific terms. It would, in fact, be quite readily intelligible to the average layman with no previous knowledge or experience of dairying. Inevitably, therefore, the treatment is elementary and in parts superficial ; the book is not likely to appeal to the more serious student. Nevertheless, the information given is basically sound and accurate, and although the book deals entirely with American conditions, it might find a place as an introductory text-book for students attending farm institutes or part-time evening classes.

An outline is given of the reception, filtration, pasteurization, cooling, and bottling of liquid milk, which covers fundamentals, but includes little practical detail. In particular, a fuller treatment of milk bottle washing, filling, and capping would have been valuable, and more detailed guidance might have been given on methods of controlling the sterility of milk bottles and other equipment, and the choice of detergents (other than the advice of manufacturers). Systems of refrigeration might also have been discussed more fully. Two statements are open to dispute : namely, that investigations on the nutritive value of pasteurized milk have yielded inconclusive results, and that milk bottles may be sterilized satisfactorily by ultra-violet irradiation. The preparation of homogenized milk, cultured buttermilk, and chocolate milk is treated in some detail ; some readers may find this guide to American practice of interest.

Description of dairy manufacture is limited to the production of creamery butter, cheese, and ice cream.

The chapters on butter-making are sound, though limited to a general outline. Plant operatives would probably welcome more comprehensive instruction on moisture control and a rather more extensive treatment of butter-making calculations. The chapters on cheese deal solely with the cottage, cream, and *Neufchatel* varieties, and will therefore be of little interest to dairymen in Britain.

The ice cream section occupies a considerable portion of the book. The subject is discussed fairly fully, and the reader will find a good summary of current American practice in this field, including the use of ingredients not yet readily available in Britain.

Two suggestions may perhaps be permitted. Firstly, it is unfortunate that no diagrams of dairy plant and equipment are given ; in a book such as this, even the simplest of diagrams would be invaluable to the reader for whom it is intended. Secondly, the alphabetical arrangement of subject-matter seems over-ambitious. The material presented is neither adequate to provide a standard book of reference, nor does it include many details likely to be of interest to the plant operator. A conventional text-book arrangement might have been preferable and would have avoided much unnecessary repetition of identical material within a comparatively small volume.

E.L.C.

Search. No. 1 (January, 1951). Plant Protection Ltd.

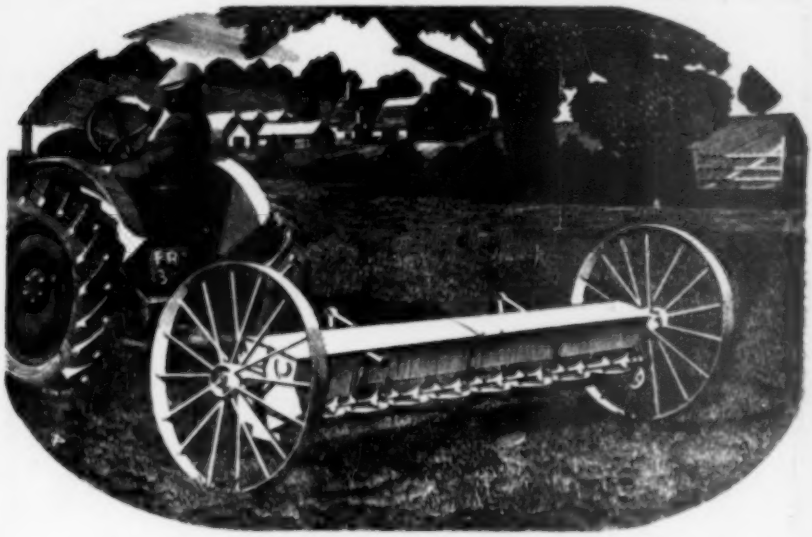
This new periodical of 40 pages is likely to be widely welcomed by all who are concerned with the unremitting fight against the depredations of crop pests and diseases. As Sir Wallace Akers rightly points out in the Foreword, " If mankind is to live, mankind must eat, and with a prospective increase of five hundred million in world population in the next twenty years, it is clear that we simply cannot afford a continuance of the losses which, unchecked, pests and diseases inflict upon world harvests". Articles in this first number include discussions on the use of BHC and phosphorus insecticides, pre-emergence weed-killers, and chemical weed control in grassland. It is proposed to issue this periodical at intervals of three or four months, and copies are free on application to Plant Protection Ltd., Bolton House, 61 Curzon Street, Piccadilly, London, W.1.

S.R.O'H.

The Landsman's Library announces their new classified catalogue (No. 4), covering literature of current interest concerned with Farming, Gardening, Forestry and Rural Life. Price 1s. (free to members). Address: Hartford, Huntingdon.

Printed in Great Britain under the authority of HIS MAJESTY'S STATIONERY OFFICE by Staples Printers Limited at their Kettering, Northants, establishment.

(1448) Pa. 719 17/DS K1231 12/50 SP/TBH Gp.821



Fertilizers can cost less this year

A grant of up to ONE-THIRD of the cost of fertilizers (maximum of 25/- per acre for half your total acreage of temporary and permanent grassland or rough grazing) can be claimed through the Government's Grassland Fertilizer Scheme.

For example :

You can dress half your grassland with from 5-6 cwt. of a compound fertilizer at a lower cost per acre than last year, e.g. :

MARCH 1950	
5 cwt. Fisons No. 6.	**£2.10.7**
MARCH 1951	
5 cwt. Fisons No. 6.	**£3.5.10**
Less one-third Grant	**£1.1.11**
	£2.3.11
Cheaper per acre by	**6. 8**

Ask your merchant or write direct to your nearest Fisons Sales Office for particulars of suitable Fisons grassland fertilizers for your area.

It's Fisons for Fertilizers

FISONS LIMITED

Head Office: HARVEST HOUSE, IPSWICH